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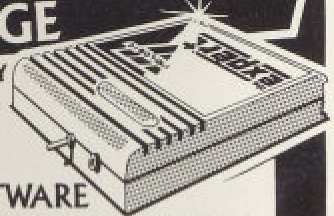
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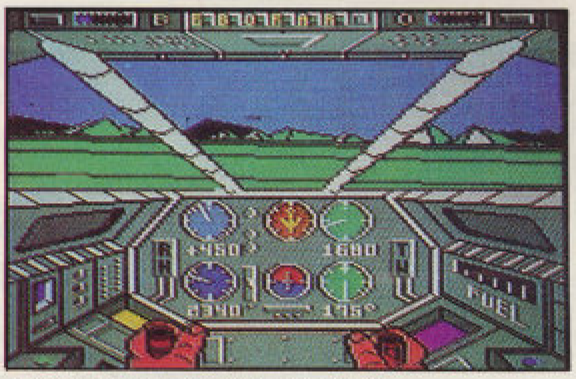
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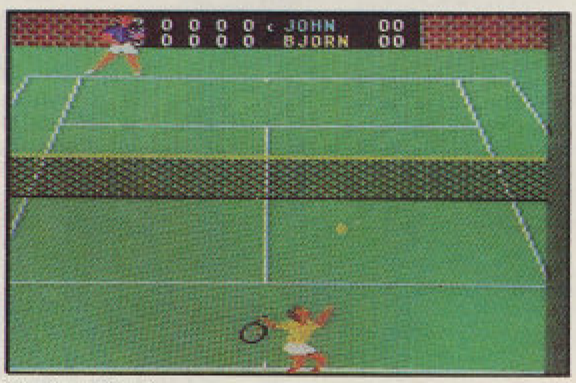


REGULARS



Above: Infiltrator. Below: Winter Games





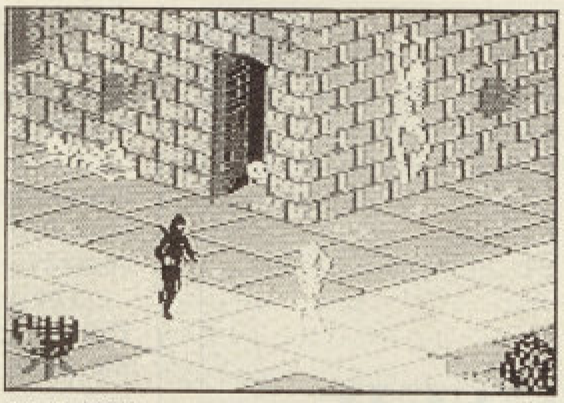
On-Court Tennis

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FEATURES



The Last Ninja

UTILITIES


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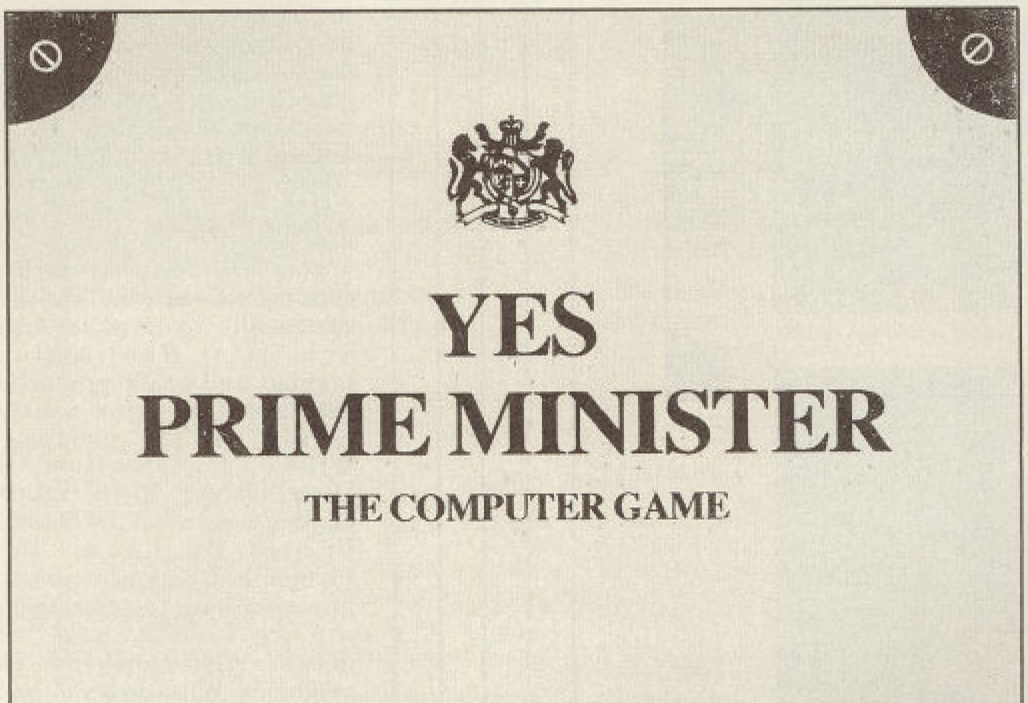
Base Characters

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ARGUS PRESS GROUP

DATA STATEMENTS



Television Tie-ins

There has been a sudden spurt of TV related titles in the last few weeks.

First, Mosaic Publishing is launching *Yes Prime Minister*, a game launched on one of the most popular comedy programs of recent years.

The player takes the part of Jim Hacker and must raise his standing in the polls during five days of turmoil and crises.

The game is available on C64 cassette at £14.95 and disk at £19.95.

TV games, Domark's new label, has announced the launch of three new titles for the C64. All based on popular television shows, the games are *Countdown, Bullseye* and *Treasure Hunt*, and all feature many of the familiar aspects of their counterparts on the box. All will cost £7.95.

Touchline:

Mosaic: *Gorley Firs, South Gorley, Fordingbridge, Hants SP6 2PS.* ***Tel:*** *0425 57055.*

Domark: *Domark House, 22 Hartfield Road, Wimbledon, London SW19 3TA.* ***Tel:*** *01 947 5622.*

Sport for All

Electronic Arts has recently released a whole host of sports games for the C64, so here's a quick run down of what's available.

Skate or Die is on C64 cassette (£9.95) and disk (£14.95). It's a skateboard simulation in which you have to compete in five different competitions. The contests re modelled on real championships and feature events like Ramp Freestyle, Downhill Race and Ramp Hill Jump.

Mini-Putt for the C64 (cassette £9.95 and disk (£14.95) is a crazy golf game in which nothing is as it seems. A smooth green can suddenly come to life and gobble your golf ball!

Test Drive is a driving simulation which lets you experience the thrill of driving some of the world's top cars including a Ferrari Testarossa and a Lamborghini Countach. The simulation displays the interior of the car and the road to give the feel of a real test drive and the object of the game is to drive sections of the road within a given time limit.

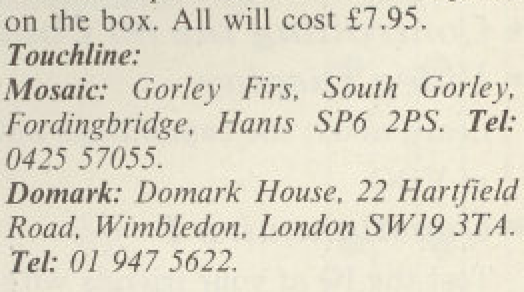
Test Drive is available for the C64 at £9.95 cassette and £14.95 disk and is also out on the Amiga at £24.95.

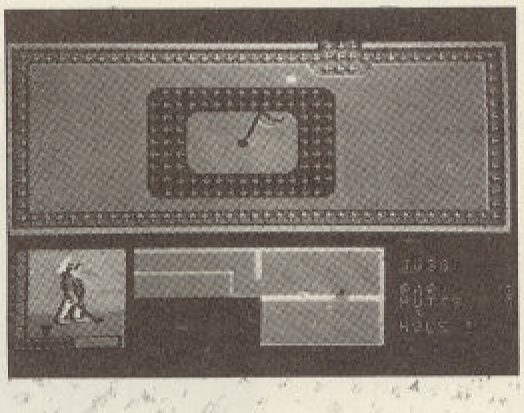
Commodore has announced the release of an Amiga *Sports Pack* and a Commodore 64 *Sports Pack*. Each pack contains an assortment of sports games, a full size canvas bag and a 'Win a day at Chelsea' competition.

Touchline:

Electronic Arts: *Langley Business Centre, 11-49 Station Road, Langley, nr Slough, berks, S13 8YN.* ***Tel:*** *0753 49442.*

Commodore: *Commodore House, The Switchback, Gardner Road, Maidenhead, Berks SL6 7XA.* ***Tel:*** *0628 770088.*





DATA STATEMENTS

Generally Speaking

The UK's first Technology Graduate Recruitment fair is to be held at the Novotel, Hammersmith 8-9 January 1988.

Chris Boon, of organisers Intro UK, said: "Since launching the fair, we have been very pleased by the initial take up of stands." Companies committed to appearing include Barclays' Bank, TSB, Dow Chemical, Thames Water Authority and Rank Xerox.

Exhibitors are hoping to attract graduates with technology and computing backgrounds at the specialist event.

Also relevant to those interested in computers, is the Data Protection Act 1984. The final elements of the Act came into force in November and will affect everyone in the UK.

For the first time, every man, woman and child has the legal right to see what is held on computer files about themselves and where appropriate to have the information corrected. It also gives individual the right to compensation under certain circumstances.

Lives can be seriously affected if inaccurate data is held about individuals. For instance, credit worthiness could be undermined or employment prospects blocked.

For further information about the Act and your rights under it, contact the Office of the Data Protection Registrar at the address in Touchline.

Touchline:

Intro UK: *Crays Pond House, Crays Pond, Reading, Berks, RG8 7QG.* ***Tel:*** *0491 681010.*

Office of the Data Protection Registrar: *Springfield House, Water Lane, Wilmslow, Cheshire SK9 5AX.* ***Tel:*** *0625 535711.*

In the Arcade

Domark, always on the lookout for big licensing deals, has just released a C64 version of *Star Wars*. The game is a conversion from the original licensed Atari coin-op game and bears a close resemblance to it.

You select your own difficulty level and then you're placed in charge of an X-wing fighter and are ready to fight the forces of the evil Darth Vader. The C64 cassette version is £9.95, and the disk version is £19.95.

Amiga News

The Amiga 500 has been reduced in price by Commodore to £499.99 including VAT. The announcement came recently after weeks of speculation over the pricing of the Amiga 500, the smallest machine in the Amiga range.

Boxed with the computer, and inclusive in the price, are *Deluxe Paint* from Electronic Arts and *The Very First* tutorial pack.

Tom Hart, National Sales Manager Consumer Products Division, said: "We believe that £499.99 inclusive of VAT offers a significant incentive to the consumer during the Christmas period and the months ahead. This is the only price change both are for the remainder of 1987 and for the forseeable future."

Software is still being launched thick and fast for the Amiga range, a large percentage coming from US companies. Electronic Arts is no exception, having recently announced the arrival of four new Amiga products.

Three of these are musical. *Instant Music* (£24.95) allows even a novice to compose and play impressive sounding pieces. The program uses a non-standard form of musical notation which, it is claimed by EA, is exceptionally easy to read and a remarkable user interface to make creating music as easy as possible. Nor will *Instant Music* ever let the user play out of tune or out of rhythm.

The two other musical products are library disks to accompany *Instant Music*. These are: *It's Only Roack 'N Roll* and *Hot and Cool Jazz*. Both will retail at £9.99.

The fourth EA Amiga release is *Earl Weaver Baseball* a sports simulation co-written by two top baseball managers Earl Weaver and Eddie Drombrower.

The arcade mode of the game is a challenging sophisticated simualtion which features high resolution graphics and realistic digitised sound. However, there is a major strategic element to the game, in that players can step into the manager's shoes to set line-ups, trade and draft players, yank pitchers and outwit a variety of opponents including Earl WEaver himself. Players also get the chance to design their own baseball park. The game is priced at £24.95.

Sentinel Software has announced a price reduction for the *Word Perfect Amiga* word processor. Formerly £255, the program will now sell at £199.

Sentinel is also continuing its trade in offer to *Scribble* owners. Anyone currently using *Scribble* can obtain a £50 refund off the cost of *Word Perfect Amiga*. Simply send your old master disks and manual with a copy of your invoice for *Word Perfect Amiga* to Sentinel Software at the address in Touchline and you will get a £50 refund.

Touchline:

Commodore: *Commodore House, The Switchback, Gardner Road, Maidenhead, berks, SL6 7XA.* ***Tel:*** *0628 770088.*

Electronic Arts: *Langley Business Centre, 11-49 Station Road, Langley, Near Slough, Berks SL3 8YN.* ***Tel:*** *0753 49442.*

Sentinel Software: *Wellington House, New Zealand Avenue, Walton-on-Thames, Surrey KT12 1PY.* ***Tel:*** *0932 231164.*



DATA STATEMENTS



Richard Hanson, Managing Director of Superior Software gets to grips with Bonecruncher.

Domark is also planning future games based on the films *The Empire Strikes Back* and *The Return of the Jedi.*

Octapolis is a new arcade game from English Software. Set in the year 3987 the small planet of Octapolis is faced with the might of the Imperium. Luckily a secret weapon is available, enormous mental power. No enemy ship could approach and expect its crew to remain sane and sensible.

However the Imperium secret service has been trying to find a space pilot who would penetrate the zone around the planet and find a way through, so that Octapolis could be wiped ut. Now a hero has been found and it's you.

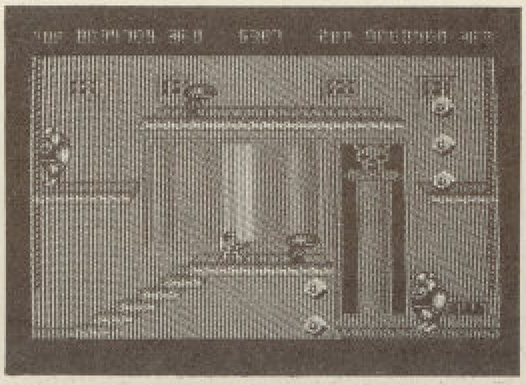
Game features include split screen two way perspective scrolling, 40 detailed play areas and sound effects to match. It costs £9.95 for C64 cassette and £12.95 for the disk.

Imagine has released *Freddie Hardset*, an arcade action game for the C64 (£8.95 cassette and £12.95 disk). The game originated from Spanish software house Dinamic.

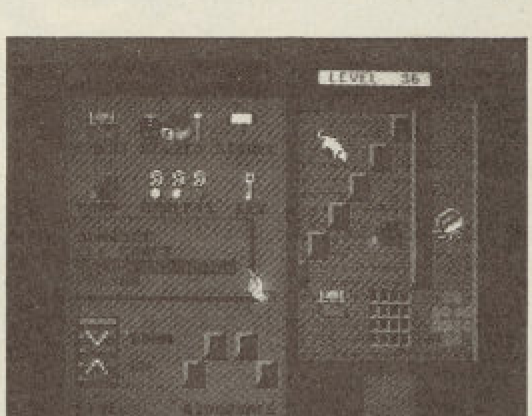
Freddie Hardset is a counter-espionage agent, skilled in martial arts and laser weaponry. However, Freddie habitually drinks too much and one night manages to crash his space ship on an enemy planet. The only way he can escape is to hi-jack an enemy space ship without being killed by human-reptile mutants, immune to laser fire.

Mirrorsoft has released a new Tony Crowther game for the C64 on disk (£12.95) and tape (£9.95). The game is called *Zig Zag* and is set in the twelfth dimension. As a trainee space pilot, you must face the ultimate challenge, the Matrix of Zog. Created to find the supreme space pilot, it has yet to fulfil its purpose. Your aim is to find the eight crystals of Zog and escape to what lies beyond the Matrix.

As an incentive to would-be super-pilots, Mirrorsoft is offering a ghetto-blaster signed by Tony Crowther to the first five players who finish and discover the code on the hi-score table.







Superior Software is also offering prizes to accomplished games players. *Bonecruncher* is Superior's new arcade adventure for the C64 (£9.95 cassette and £11.95 disk) and the Amiga (£14.95). Bono is a baby dragon who runs a bath house in the depths of the sea for monsters fed up of stagnant water. Unfortunately, the baths attract some undesirables who love to eat baby dragon meat.

The competition can be won by anyone who finished the game. Each player who completes *Bonecruncher* successfully can claim a portable radio complete with headphone, a Bono badge and a winner's certificate.

In *Out of this World*, on the Reaktor label, you (Chuck Harison) and your C64 (an RP2-16 fighter jet) find yourselves in The Other World and have to negotiate eight levels, seven bonus levels and hostile enemy ships in order to make the enemy surrender. The game is available on cassette and disk at £9.99 and £12.99.

Electronic Arts has launched *Demon Stalker*, a one or two player arcade game for the C64.

Demon Stalker contains 99 levels of amazing mazes, all with different goals, messages, monsters and magic. And level 100 contains Calcrak the Demon, ready to battle with unwanted intruders. On each level are many useful items but you have no way of knowing if they are good or evil so be prepared to take risks. The cassette version of the game is £9.95 and the disk version costs £14.95.

Touchline:

Domark: *Domark House, 22 Hartfield Road, Wimbledon, London SW19 3TA.* ***Tel:*** *01-947 5622*

English Software: *1 North Parade, Parsonage Gardens, Manchester M3 2NH.* ***Tel:*** *061 835 1358.*

Imagine: *6 Central Street, Manchester M2 5NS.* ***Tel:*** *061 834 3939*

Mirrorsoft: *Athene House, 66-73 Shoe Lane, London EC4P 4AB.* ***Tel:*** *01 377 4837.*

Superior Software: *Regent House, Skinner Lane, Leeds, LS7 1AX.* ***Tel:*** *0532 459453.*

Reaktor: *9 Disraeli Road, Putney, London SW15 2DR.* ***Tel:*** *01-785 4283.*

Electronic Arts: *Langley Business Centre, 11-49 Station Road, Langley, Nr Slough, Berkshire SL3 8YN.* ***Tel:*** *0753 49442.*

Solid Gold

Go for gold in the latest in game compilations.

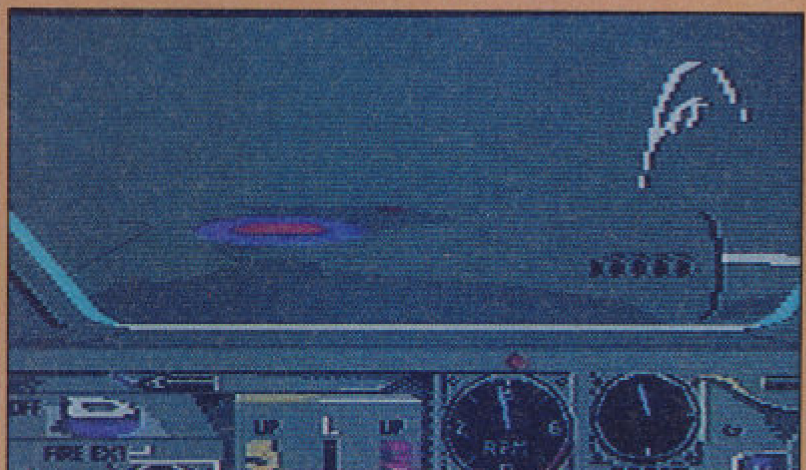
By Tony Hetherington

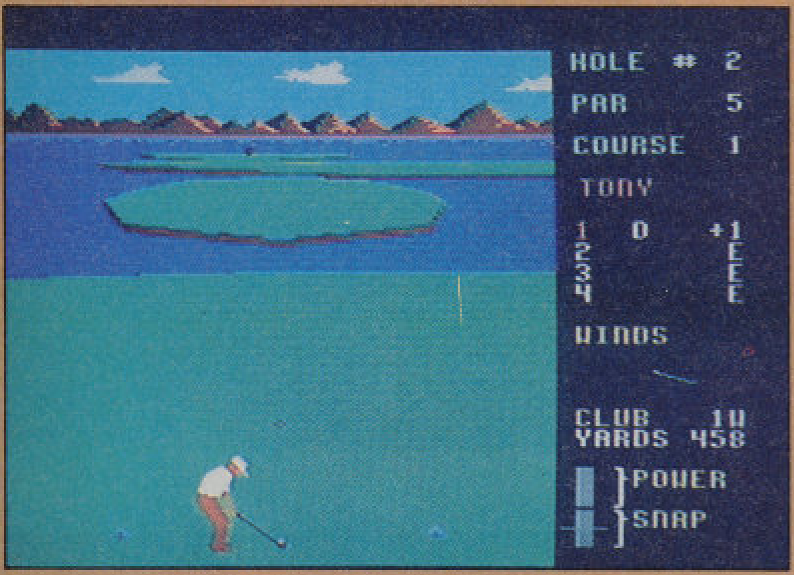
Compilations come and go and offer you a gaggle of goodies for the price of one game. They usually consist of one chart topper, two also rans and a few lemons. So the usual advice from reviewers is to buy it if you haven't aready got the good game. Now US Gold has changed all that with Solid Gold, a compilation of five great games. Now the advice is simple – buy it!

Gauntlet leads the impressive line-up that also includes the combat flight simulator Ace of Aces, the original version of Leader Board, the best of the "event" sports games, Winter Games, and Infiltrator which is a flight simulator, commando game and arcade adventure all rolled into one.

Gauntlet took the covetted Christmas number one spot and is the conversion of the classic coin-op machine that was so popular that a slot for £1 coins was specially fitted to so players could cram in their money. The C64 version captured the excitement of the battles of a warrior,









wizard, elf and valkirie (two at at time) against ghosts, grunts, robbers, sorcerers and the aptly named deaths as they bravely delve deeper into the dungeon.

A staggering 512 levels packed with monsters and mayhem lay ahead as they search for treasure, keys to open doors, magic potions, amulets of invisibility and food to top up their health points. As monsters munch you and poisons drain you then the health points are lost. Run out of health points and you run out of game.

Gauntlet is a fast and furious game that's played in a state of semi-controlled panic by players that once bitten, are hooked for hours and hours. Unbdoubtedly, the pick of the coin-op conversions.

Ace of Aces takes you to the skies in the pilot seat of a Mosquito fighter bomber. The game begins in the briefing room where you can choose to bomb a POW train carrying prisoners to Berlin, attack submarines before they escape to the open sea, deflect V1 rockets from their deadly course to London or dogfight with a squadron of 109's. If you want to become the Ace of Aces you will have to attempt all four at once!

Once airborne you certainly have your work cut out as you have to plot your course to that target, control both engines, select between guns, rockets and bomb weapons and fight off attacking ME109's.

Leader Board was the first of a series of four golf games from Access, the people who brought you subtle games such as the screaming Beach Head II and Raid over Moscow. Despite the lack of chaos and killing (the normal Access trademarks) the Leader Board courses can be viscious particularly to novice golfers.

Unlike other golf simulations that pontificate over club selection and fine angles Leader Board is a LOAD and go game.

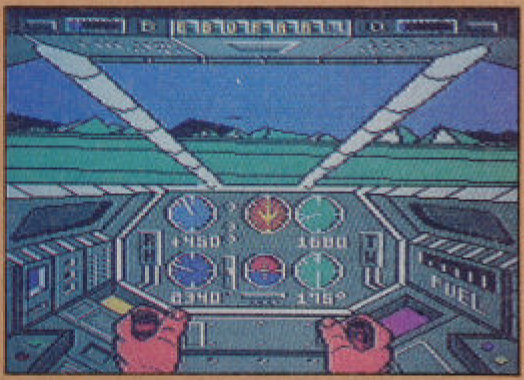
Hit and Hope tactics seem to work as well as any other which makes it a real games players game which probably explains why it shot straight into the number spot in the charts.

The courses are a bit limited and consist of islands set in a massive lake so if you manage to stay out of the drink you'll probably get a good score. If you enjoy Leader Board then it's probably worth investing in one of its three sequels. Leader Board Tournament added four new but equally wet courses, the Executive version dried out the course and added trees and bunkers and finally World Class Leader Board is the definitive version complete with a top down map of each hole.

Winter Games was the third in the Epyx "Games" series that began with Summer Games 1 and 2 and has since continued with World Games and recently California Games. Winter Games, another chart topper, is still my favourite.

Gruelling events push joystick atheltes to their limits as they go for gold in the ice and snow.

Superb graphics form the backdrop for events such as the ski jump and bobsled as well as the curious Hot Dog Ariels in which contenders must perform acrobatics while leaping off a ski slope! Skating comes in the three varieties of speed, figure and free but the most gruelling event has got to be the biathlon. This is a cross crountry race against time in which you must also shoot targets to get a good score and a chance of a medal. After the biathlon, the 1500m will be easy.



Last but no means least **Infiltrator** casts you as Johny "Jimbo-Baby" McGibbets as you set off in your super helicopter to save the world once again. This time the Mad Leader is up to his old tricks again and you must stop him.

In the first of three missions you must fly your Whizbang Enterprises Gizmo Attack helicopter through enemy airspace then land and infiltrate the enemies base. With only your usual toolkit of sleeping gas, false papers and gas grenades you must search the base and photograph the Mad Leader's plans and then escape back to base. This mission leads you through a combat simulator to a commando style arcade adventure and back again in one amazing game.

Each of these games is a classic in its right but together for only £9.99 they are pure solid gold.

Touchline:
Title: *Solid Gold.* ***Supplier:*** *US Gold, 2/3 Holford Way, Holford, Birmingham B6 7AX.* ***Tel:*** *021-356 3388.* ***Machine:*** *C64.* ***Price:*** *£9.99 cass/£14.99 disk.*
Originality: *4/10.* ***Playability:*** *10/10.* ***Graphics:*** *9/10.* ***Value:*** *11/10.*


21st CENTURY WARRIOR:
APACHE
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TM

Byting into the 6510

This month we continue our typewriter program in machine code by adding an interrupt driven cursor and find out more about the machine stack.

By Burghard-Henry Lehman

Personally, I consider the most exciting thing about computers is their tremendous flexibility. Even though they are only machines, they are the most versatile kind ever invented. This opens the way for unlimited creativity, and at the end of the day, a computer is as good as what you make of it.

For example, you may be forgiven for thinking that since you bought yourself a Commodore 64 you are lumbered with a slow and pretty limited Basic for ever. But the moment you learn something about how flexible the machine really is, you'll find that this is only the tip of the iceberg. The deeper you get into the C64, the more you will discover that it has been designed in ways which literally beg you to make more out of it. In the end you could change your computer so completely that you could have a brand new computer every week! And this is not really as difficult as you might think. In fact, the designers of the C64 made sure of that in several ways.

In the following article we will discover a powerful way of changing your C64 considering the use of vectors.

Vectors

In the last article in this series I told you a little about the maskable interrupt which is called upon every 60th of a second and enables the computer to read the keyboard and print the flashing cursor. Now we want to use this knowledge and create our own cursor.

First of all, let's look at exactly what hapens every 60th of a second.

Each time the interrupt is called the microprocessor is made to jump to the last location of the C64 which is hex FFFE or decimal 65535. Actually, it's not really jumping to this address, but using this uppermost location to find out where to jump to next. (You might like to know that all processors of the 6502 family, to which the 6510 belongs, are programmed to read the vector at $FFFE. But from there all machines take different routes).

So this is what a "vector" is all about. It is very similar to what we have already learned when dealing with indirect addressing – the contents of two locations point the microprocessor to the address of another location.

The vector at the top of the C64 tells the 6510 to jump to a routine at hex FF48, decimal 65352. This is the start of the interrupt routine and begins with the 6510 saving the contents of all its registers and so afterwards, it can continue with whatever it was doing before. It is then made to jump via another vector.

This vector is located in RAM, at hex 0314 or decimal 782, and is the one which interests us most. Because it is located in RAM we can change it and thus make the 6510 jump to our routine, instead of the usual routine in ROM.

Driving a Wedge

Vectors are very useful because they permit flexibility in the design of a micro. When a computer first comes onto the market the operating system is seldom as fully developed as hoped. There are very often bugs present (the people who program the operating system are just as fallible as the rest of us...). It is also very likely that the designer comes up with ideas for improved facilities.

Without vectors those changes in the operating system would mean that the whole program would have to be re-written completely. It would also mean that some of the hardware of the computer might have to be re-designed and this would result in a lot of very unhappy people who have spent their hard-earned money on a brand new micro, only to find themselves within a very short time lumbered with a machine which is hopelessly out of date. This problem can be solved by using vectors which are fixed locations, either in RAM or in ROM. All that has to be changed now is the contents of the vector location, which makes the microprocessor jump to the new or modified routine.

Vectors are also very useful to the humble programmer. If a vector is in RAM, he can change it and make the microprocessor jump to his routine instead of the one in the operating system. This is called "driving a wedge", and is used by all the extended Basic programs available for the C64.

We will also use this method, for programming our own cursor.

Turning the Cursor On

The interrupt routine which I have run into a separate source file (located at 50000 – see listing 2) consists of three routines:

- the routine, which turns our cursor on.
- the routine, which turns it off.

• the interrupt routine itself, which is called upon every 60th of a second via the vector at $0314.

"Turning the cursor on" could sound a little misleading, as we don't infact turn anything on or off. All we do is change the vector at $0314. But for our purpose this means, that from then on our cursor is "turned on", in the sense that the computer will now jump to our routine instead of the one in Kernal-ROM which is located at $EA31.

Later on, when we "turn the cursor off", we will do the opposite, i.e. change the vector back to normal.

As you can see from lines 150 and 250 (and 330 and 380, respectively), I have introduced two new op-code mnemonics: "SEI" and "CLI". You may remember that in the last article I said that we are dealing with a "maskable interrupt", that is an interrupt which can be turned on and off by software.

This is exactly what "SEI" and "CLI" do: "SEI", which stands for "SEt Interrupt flag", disables the interrupt. "CLI", which stands for "CLear Interrupt flag", enables it. The interrupt flag is bit 3 of the flag register of the 6510. If this flag is clear (0), the microprocessor executes the interrupt every 60th of a second. If it is set (1), it doesn't.

It is very important to disable the interrupt while we make the 6510 change the vector. Remember, in the time which it takes you to read lines 160 to 190 in our program listing, the 6510 will have called the interrupt at least sixty times! So it could easily change part of the vector at $0314 and then jump to the interrupt, using the same vector which it has just partially changed. This would result of course in it jumping to somewhere quite nonsensical! And this, in all likelihood, will mean a complete crash!

So we have to prevent the 6510 from following the interrupt while it is changing the vector.

In lines 210 to 230 I zero the two variables ("CURSFLAG" and "COUNT"), which will be used in the interrupt routine itself. More about this in a minute.

Flashing the Cursor

What does "flashing the cursor" mean? (and I am not thinking of the possible naughty connotations...)

In slow motion it means that there are two states in which a certain position on the screen can be: in the normal C64 mode you either have the character at that position printed normally or in reverse. The flashing effect comes from the machine alternating between these two states.

What happens is very simple – some of the time the interrupt is called, it prints the character in normal, while the rest of the time it prints it in reverse.

If it alternated between these two every 60th of a second, it would happen so quickly that you wouldn't be able to see the cursor. All you would get at that position is a bad case of flicker.

Therefore we have to introduce a timing device to make it alternate about once a second. This is what the variable "COUNT" is all about, which I introduced in lines 210-230. (Of course, by changing the value in "COUNT" you could easily change the timespan to suit your taste!)

It starts off with "COUNT" = 0. And every time the interrupt is called, this is bumped up by one (line 580). Then it is loaded into the accumulator and compared with 20 (lines 580-610). If it doesn't equal 20, the program exits straight away to line 980 (JMP $EA7B makes it jump to the rest of the normal interrupt routine in the Kernal, which makes it read the keyboard as usual).

If it reaches 20, first, "COUNT" is reset to zero (lines 650-660), ready for the next go. Then it tests a variable which I have called "CURSFLAG". This contains either 0 or 1.

If "CURSFLAG" contains zero, the character "under the cursor" is reversed, by adding 128 to it (lines 740-810).

If "CURSFLAG" containes one, the character is put back to normal by subtracting 128 (lines 860-920). (I hope that you are aware, that you can do this with all screen codes, simply by adding or subtracting 128 to it...)

This is all there is to our cursor routine, except that every time "CURSFLAG" is zero, we load it with one and every time it is one, we clear or reset it. Don't think me too pedantic mentionig this little matter, because if you overlook it I can assure you the computer won't! And this will result in the cursor being off most of the time, which means you won't have a cursor!

Turning the Cursor Off

As I've said already, lines 310-390 turn our cursor off, by changing the vector at $0314 back to normal.

I mention this specifically, because if you use your own interrupt routine you should always turn it off, when you don't need it any more!

The first reason for this is that your interrupt routine might slow other operations down, such as loading or saving to disk or tape, especially if your interrupt routine is longer than the one in ROM.

Secondly, it is easy to forget that your routine will indeed be executed every 60th of a second! Therefore, some of the variables which you use in the interrupt routine might be used by the operating system or by the program you are running in the meantime.

For example, if you use my "Speedy Assembler" routine (notice the subtle plug!), you should always turn off any interrupt routines you are experimenting with, before reassembling them. And above all, take care to reset all vectors as they were before. "Speedy Assembler", like many other programs of this kind, changes some of the vectors for its own purposes. If you want to be safe, exit from the assembler, run your program and then re-enter "Speedy Assembler" by typing "SYS 22623".

Introducing a Textfile

Having created our very own cursor (and I hope you will feel free to experiment with different versions) we now want to expand our typewriter routine in order to see our cursor working in all its aspects.

Figure 1
SEI=SEt Interrupt flag
CLI= CLear Interrupt flag
PHA=PusH contents of the Accumulator
PHP=PusH contents of the Processor status register
PLA=PuLl contents of the Accumulator
PLP=PuLl contents of the Processor status register

The main program in Listing 1 is similar to my last one, apart from the fact that I've added quite a few facilities to it, which makes our program more like a wordprocessor.

First of all, I have introduced a textfile which is useful for saving the text we have written and also sending it

to the printer later on. A textfile is an area in memory (in my case starting from 10000 but you can change this to any location which suits you) which stores the printable characters we have typed. In lines 140-170, "TEXTFILE" is initiated, and in line 780-790 the ASCII-character which results from the keypress is put into "TEXTFILE".

The accepted way to store characters with wordprocessors is in ASCII and not in the Commodore screen codes. Printers, including the Commodore printers, know nothing about screen codes, and later on you might even want to send a textfile down the line to another computer. ASCII is the standard and Commodore screen codes aren't!

Having introduced a textfile we have of course to take other routines into acount! In other words, we are now dealing with two "current positions": one on the screen and one in the textfile! Both have to be updated in concord.

CRSR Left and Right

Since we have now got a cursor, we naturally need to move it! To this purpose I have built a cursor left and right faciity into the program. And here I have been more clever than usual! Instead of writing two separate routines I have built both facilities neatly into the existing routines.

The idea is simple, if you move the cursor to the right, it is the same as if you enter letters – only without the letters, if you get my drift...

On the other hand, if you move the cursor to the left, it is like deleting characters – only without actually deleting anything.

Therefore, cursor right fits neatly into the normal writing routine, while cursor left goes into the deletion routine.

With the cursor routine, the only important thing is, that I don't want the cursor right ASCII-character, which is 29, to be printed on the screen, because this would give me "]", as it happens. So whenever CRSR right is pressed, the program jumps straight to line (980) where the print position (both on screen and in the textfile) is updated.

For cursor left I had to do some modifications to the deletion routine:

First of all, in lines 1340-1390 I used the X-register instead of the accumulator to test for the beginning of the screeen. This is because I do not want to corrupt the contents of the accumulator, which at this point contains the result of the last keypress.

Then I save the contents in the accumulator by pushing it onto the machine stack (line 1430). (More about this in a minute!). This allows me to decrement the print position one to the left, as usual. It suits me that it recovers the character to the right too, because in this way I get rid of the cursor!

Afterwards I pull the contents of the accumulator from the machine stack (line 1760) and give it another test. If it contains 20, then it is the deletion routine, if it contains 157, then it is cursor left, which means that no further action needs to be taken. It jumps straight to the exit in line 1890.

Pushing and Pulling

In the first article of this series I briefly mentioned the existence of the so-called machine stack.

The trouble with the machine stack is that, like so many others in computing, it is thought of as mysterious, and difficult. In reality it is nothing more than another area in the computer-RAM (starting at $0100 or decimal 256 – the next page after zero-page) which is used for storing data.

These data-bytes are simply piled on top of the other. This has the effect that the machine stack grows to the roof. (Where else should it grow, if you pile things on it?). With heaps like this it would of course, not be a very good idea to retrieve items by pulling them from the bottom or the middle. If you do this with a pile of books, you might easily have a nasty accident. Nothing like this happens with the machine stack, but the data-byte you pull is meaningless to the computer.

So, you "push" things onto the top of the stack and you "pull" them back from the top again. The secret of the whole thing lies in the sequence in which you do all your pushing and pulling:

If you push A, B, and then C, and you want then to start pulling things again, the first thing you get is C, B, and finally A. The whole secret of using the machine stack lies in pulling first what you pushed last, and pulling last what you pushed first.

The 6510 actually has a special register – the "stack pointer", which you can program and therefore change the top of the stack, as it is perceived by the computer. But this is something for connoisseurs and kamikaze pilots. You also always have to bear in mind the machine stack, and whether its proper functioning is vital to the proper functioning of the computer as a whole!

Because every time the 6510 jumps to a subroutine it pushes the return address onto the stack. If, at the end of that subroutine, it can't retrieve the proper address back from the stack, it is well and truly lumbered!

So, if you push something onto the stack, always be sure to pull it before you leave the subroutine you are in!

The advantage of using the stack to store things, is that it is convenient and cheap in memory. "PHA" and "PLA" together use only two bytes, and that's half the length you need if you store in a zero-page variable. The disadvantage arises if you are not quite certain whether you will have pulled before you exit.

For example, at the beginning of our deletion routine I could have pushed unwittingly the contents of the accumulator onto the stack before I tested the screen position in lines 1340-1390. But this would result in the stack getting out of order every time the user presses the deletion key at the beginning of the screen. Because it would then jump straight to the exit in line 1890 and this would mean that there would be no equivalent pull from the stack! This would have created the type of classic machine code bug that usually takes days to find!

Unlike other microprocessors, the 6510 allows you to push only two registers onto the stack: the accumulator and the flagregister. "PHA" stands for "PusH the Accumulaotr onto the stack", while "PLA" stands for "PuLl the Accumulator from the stack". To push and pull the flag register use "PHP" and "PLP" respectively.

And Finally

Everthing else in Listing 1 is very much the same as it was last time. I would like to give a special mention to lines 430 and 1980 which turn our cursor on and off and thus activate and de-activate our interrupt routine in listing 2.

I'll leave you with a little something to try for yourself. What about adding a CRSR up and down routine to our program? Here comes the only hint I am willing to give you – you have to add 40 to the screen (and textfile) position for CRSR down and subtract 40 for CRSR up. YC

See listings on page 77.

80 Character Print Out

Improve the printing powers of your C64 to produce 80 characters per line with this handy program.

By Jens Meyer

This program enables the Commodore 64 to print 80 characters per line instead of the usual 40. It does this by using the graphics screen, and not the text screen. All inputs are diverted to the graphics screen, where the letters are printed to half their normal width. Despite the fact that they are much thinner than normal letters, they are still clear and can be read easily.

The program is written entirely in machine code, but can be loaded normally and started using "RUN".

After loading you will be asked if you want the Eprom version – type 'N' for no and 'Y' for yes. If you select yes, a new version of the program starting at $2000 will be saved to disk, enabling the user to program an Eprom with it later on, if you have the necessary equipment. The Eprom has some advantages to the normal version. It is much more compatible with other programs, as it is "Hidden Away" under the ROM and not stored in the Basic memory.

However, most users will select "NO". This will start the program immediately and means that you can simply save it to disk or tape with no need to program an Eprom, as this version creates the 80 column display.

The Eprom option merely exists for a very small minority of people.

When the program is started, the following restrictions and changes occur:

- As the program uses the Hi-Red mode, only one colour can be used at any one time.
- The screen memory map is twice as big as usual because there are twice as many characters, and goes from $CFCF.
- It is possible to mix upper and lower case letters and graphics because the graphics mode is being used, and letters which are already on the screen will not be changed, even if, for example (SHIFT)+(COMMODORE) are pressed. The new character set is created by using bits 0,2,4 and 6 of the letters of the old character set.

Also, there is a routine in the memory which scrolls up everything on the graphics screen by 8 pixels (one line) to imitate the scrolling upwards in the text mode.

The characters are stored in both the screen memory map and the graphics bit map.

The following table shows the use of the memory by 'ROM 80':

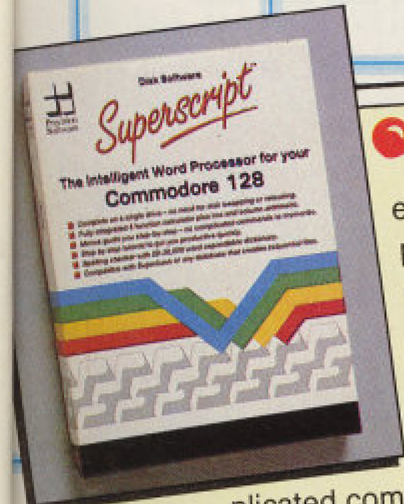
$C400-$C7FF		NEW CHARACTER SET
$C800-$CFCF		SCREEN MEMORY MAP
$CFD0-$CFFB		ROUTINE FOR SCROLLING GRAPHICS
$CFFF		PRESENT FORE - AND BACK-GROUND COLOUR
$DC00-$DFE7	($5C00-$5FE7 IN RAM VERSION)	COLOUR
$E000-$FF3F	($6000-$7F3F IN RAM VERSION)	GRAPHICS BIT MAP

But enough of all the technical details. If you want your Commodore 64 to have an 80 column display, just use 'ROM 80'.

YC

See listings on page 77.

The most powerful productivity software ever developed for your computer

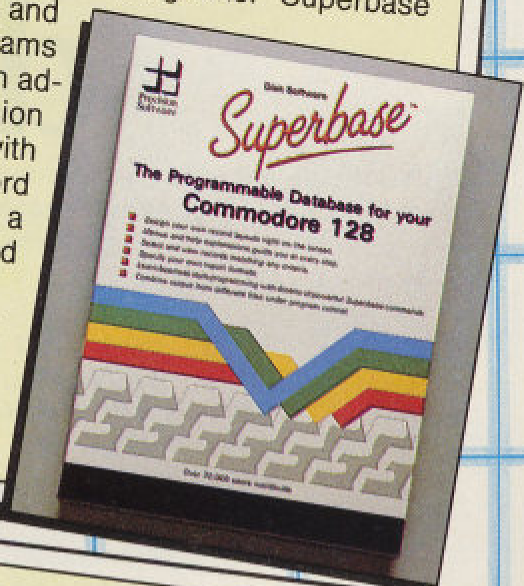


SuperScript gives you everything you need for professional word processing in one easy to use package. Its menu command structure puts you immediately at ease, with no complicated commands to memorise, yet SuperScript combines business-style editing, spell checking, calculator, row and column arithmetic and full mail merge facilities. The phrase glossary feature enables you to store whole passages of text, or command sequences and recall them with a simple key.

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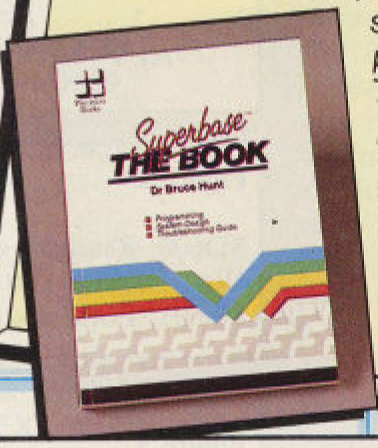
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Controlling the 80 column video display

If you own a C128 and you're eager to know more about the capabilities and limitations of VDC, then read on.

By Leigh Brown

It is useful to have a rudimentary knowledge of Machine Code as some of the operations that the 8563 can perform are not possible in BASIC. Also, it is important to remember that a monitor is needed for 80 columns and some people may not be able to afford the expensive Commodore monitor. I would advise those people to use a standard monochrome monitor.

The VDC has been designed to cater for most of the programmers' needs. For example, it has its own cursor and its own 16K bytes of RAM. However, it has a few drawbacks, but you should get used to these after using the VDC for a while. The first of these is the addressing of the VDC. All of the 37 registers are accessed via two locations in the Input/Output area of the computer. These locations are $D600 and $D601 and act as a simple Input/Output port. For example, to store 15 in register 11 you store 11 in location $D600 and then store 15 at $D601. And to read from register 11 you store 11 in location $D600 and then read the value from $D601.

Figure 1

7	6	5	4	3	2	1	0
ALT	RVS	UND	FLA	RED	GRE	BLU	INT

Figure 2

```
$D600: Read: --- ---  <<6 bits register select>>
Write:s Write: status Lpen Vblank --- --- --- --- ---
$D601: Both:  <<8 bits for reading and writing data>>
```

Figure 3

Reading to and writing from registers: Using these routines, X is the register and Accumulator holds data.

```
.write     STX $D600     /Write register
.test1     BIT $D600     /is VDC busy?      ROM COPY
           BPL test1     /yes, then wait    AT $CDCC
           STA $D601
           RTS
.read      STX $D600     /Write register
.test 2    BIT $D600     /is VDC busy?      ROM COPY
           BPL test2     /yes, then wait    AT $CDDA
           LDA $D601
```

Location $D600 also has some other uses when read. Bit 7 returns the status of the VDC, in other words whether it is busy or not, as some operations take some time. Bit 6 is used for the light pen, which doesn't concern us. Bit 5 is the vertical flyback bit, so you can synchronize events to the monitor or alter the screen without flickering occuring.

The 16K RAM of VDC

As mentioned before the VDC 'owns' its very own RAM, but it can only be indirectly accessed via the registers. This means you can redefine the character set which is held in the VDC RAM, or store directly to screen. However, this cannot be done in BASIC, so we must resort to machine code. The registers we need are 18, 19, 30, and 31. They must be written to in this order:

Store the high byte of the address in register 18.
Store the low byte of the address in register 19.
Store the byte to poked at address in register 31.
Store the number of characters in register 30.

However, the VDC stores the number of characters plus one. So in register 30 we have to store the number of characters minus one. Also, you may have noticed that you can't print one character. Oh well you can, all you need to do is *not* write the number of characters to register 30. The whole process is carried out with bit seven of register 24 cleared.

You can also copy RAM from place to place, using the same method but thankfully it works properly! The number of characters to be copied corresponds to the word count register (31). The method is basically the same as storing characters but you must set the copy bit in bit 7, register 24. The start address to be copied is stored in registers 18 and 19, and the destination address is stored in registers 32 and 33. The copying process begins when the word count register is written to.

The VDC Screen

The screen is extremely versatile – you can change the physical size of the

Figure 4

Reading and writing RAM. Writing one character:

```
.write1     PHA          /tempory store
            TXA          /store
            LDX #19      /low
            JSR write    /byte.
            DEX          /store
            TYA          /high
            JSR write    /byte
            LDX #31      /recall
            PLA          /and store
            JSR write    /data
            LDA #18      /store dummy
            JMP write    /and leave (if stand alone
.write      STX $D600    /omit 'JMP write')
.test1      BIT $D600
            BPL test1
            STA $D601
            RTS
```

Writing more than one character: Accumulator holds the character to be stored, location 250 holds number of characters minus 1, X and Y hold the low and high address of the location in VDC memory.

```
.writem     PHA
            TXA
            LDX #19      /write low byte.
            JSR write
            DEX
            TYA          /write high byte.
            JSR write
            LDX #31      /write character
            PLA          /to be stored.
            JSR write
            LDA 250      /write number of
            DEX          /characters-1.
.write      STX $D600
.test1      BIT $D600
            BPL test1
            STA $D601
            RTS
```

Reading a byte from RAM.

```
.read1      TXA          /store
            LDX #19      /low
            JSR write    /byte
            DEX          /store
            TYA          /high
            JSR write    /byte
            LDX #31      /recall
            JSR read     /and store
            RTS          /return, Acc. = value
.write      STX $D600
.test1      BIT $D600
            BPL test1
            STA $D601
            RTS
.read       STX $D600
.test2      BIT $D600
            BPL test2
            LDA $D601
            RTS
```

Continued on page 57

Questionnaire 1

Whether you wish to test your neighbours IQ or find out how clever friends at your computer club are, this program will help you.

By David Warner

Questionnaire I enables you to compile your own multiple-choice quizzes and save them out to disk for use at a later date. You can use the program just for fun or even use it for educational purposes.

The program is presented here as two Basic programs. Type them both in separately and save them out to disk. When you want to use the program simply LOAD and RUN the program "Q-BOOT". The second part of the program will then load and execute automatically.

What's the question?

Obviously before you use the program for the first time you will need to set up some questions.

When you select the 'create questions' options from the main menu you will be asked for the number of questions that you want to set. You will then be asked for each question in turn together with a number of possible answers. Once all of the information for each question is answered, you will be asked to indicate which is the correct answer.

If you find that your question is over one line in length, you must start the next line *three* spaces from the start of the second line. This is to ensure that the text will be correctly formatted when displayed on the screen.

See listings on page 77.

Save your work

When saving your questions out to disk, you may find it useful to include the number of questions within the filename. The reason for this is that you will need to tell the computer how many questions are to be loaded when you want to reuse any quizzes that you have set. As an example "HISTORY 20" would be a set of 20 history questions.

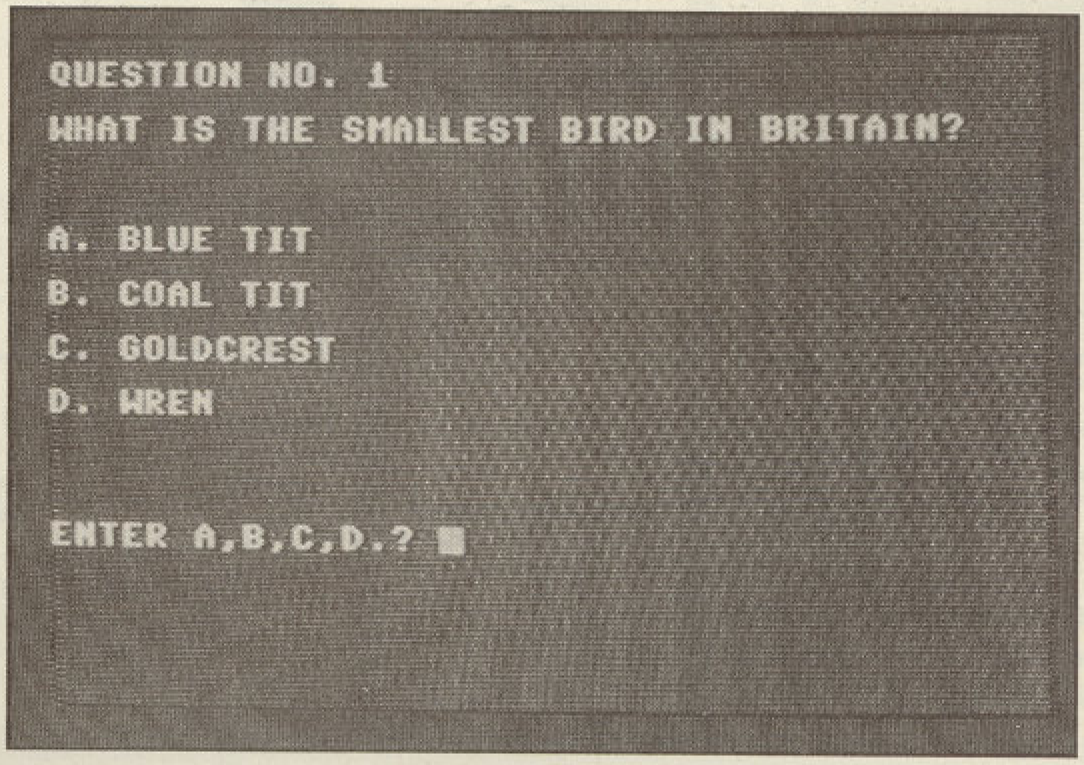
Time out

Provision is made within the program to display a clock on the screen. To use this feature you should enter the time in the format P.12.05.00 the P being PM (A for AM) and the following numbers being the hours, minutes and seconds respectively.

Software for Sale

Should you purchase this month's software for sale disk you will find that there are three sets of example questions for this program on it.

YC



May I Interrupt?

How to make your C64 reveal its split personality.

By Norman Doyle

Interrupts can make your computer do things that it was never designed to do. For example, it is impossible to have capital letters, Commodore graphics and lower case letters on the screen at the same time. The usual form is capitals and graphics with no lower case; or capitals, lower case and limited graphics.

To have everything on the screen at the same time, we have to change the screen style in mid-scan. This is known as a raster interrupt because it takes place during the time that the screen, or raster, is being scanned.

First of all, we have to tell the computer where we want the interrupt to occur on the screen. The scan time is divided into 256 parts but although a full scan takes 256 raster count units, the screen is only visible when the value lies between 51 and 251. By storing a value in $D012, you can cause an interrupt to occur at any moment during the scan period. If this occurs while the visible portion of the screen is being scanned, it is called a split-screen interrupt.

First of all, we have to set up the interrupt conditions. Listing 1 may seem familiar because it's based on the routine that I showed you last month. The new part of the initialise routine sets the raster interrupt.

The accumulator is loaded with the value which represents the point at which I want to interrupt the screen. It is stored in location SD012 – the raster compare byte. Next, the computer has to be told to expect a raster interrupt. This is done by setting the first bit in location SD01A.

You'll notice that there are two interrupt routines and that one modifies the interrupt vector (double byte $0314) to point to the other routine. So you establish two interrupt environments which are executed on alternate interrupt periods.

The basic routine causes the colours of the screen and border to change in mid-scan and the effect on the screen makes the top of the screen yellow and the bottom area black.

Apart from changing the interrupt vector, each routine has to reset the

Table 1

Command Type	Examples	No of cycles
Implied	CLC CLD CLI CLV DEX DEY INX INY NOP SEC SED SEI TAX TAY TSX TXA TXS TYA	2
	PHA PHP	3
	PLA PLP	4
	RTI RTS	6
Absolute	JSR	6
Relative	BCC BCS BEQ BMI BNE BPL BVC BVS	2*

**Add an extra clock cycle when the program takes the branch and add another if the branch then crosses a page boundary.*

value of the interrupt compare byte to that of the other interrupt value. Then the computer is told to execute the next screen interrupt by setting the lowest bit of location $D019.

In case you're wondering why two interrupt routines are necessary, consider what would happen with only one. When the first interrupt occurs the screen colour changes and will not automatically change back to the original colour. The net effect, therefore, would be to maintain yellow as the screen colour no matter what the run time program was trying to dictate. The second interrupt changes the colour so that the colour banding occurs.

The RASTER1 and RASTER2 values are arbitrary ones which I have selected for this demo. The first value must be less than 51 otherwise a black band would appear at the top of the screen – a good way to create a coloured band across the middle of the screen. RASTER2 determines where the colour change occurs, therefore any value between $43 and $FB could be used.

The second routine starts off with several NOP commands. Although these apparently do nothing, the effect is to delay the execution of the colour change so that it occurs at the end of a line. Without this delay, the interrupt would occur in the middle of the line causing glitches which may show up as flickering or create a 'step' on the smooth line of the screen split.

Such timing problems can be tackled in one of two ways. The NOP system lengthens the interrupt code and reduces the amount of time in which other things could be done. A better way of overcoming this problem is to place the colour change code further down the routine, after calculating the number of clock cycles which are needed for the delay. A list of these cycle times can be found in Table 1 and Table 2.

Table 2

	Accumulator	Immediate	Absolute	Absolute,X	Absolute,Y	Absolute Indirect	Zero Page	Zero Page,X	Zero Page,Y	(Indirect,X)	(Indirect),Y
ADC	.	2	4	4*	4*	.	3	4	.	6	5*
AND	.	2	4	4*	4*	.	3	4	.	6	5*
ASL	2	.	6	7	.	.	5	6	.	.	.
BIT	.	.	4	.	.	.	3	.	.	.	.
CMP	.	2	4	4*	4*	.	3	4	.	6	5*
CPX	.	2	4	.	.	.	3	.	.	.	.
CPY	.	2	4	.	.	.	3	.	.	.	.
DEC	.	.	6	7	.	.	5	6	.	.	.
EOR	.	2	4	4*	4*	.	3	4	.	6	5*
INC	.	.	6	7	.	.	5	6	.	.	.
JMP	.	.	3	.	.	5	.	.	.	.	.
LDA	.	2	4	4*	4*	.	3	4	.	6	5*
LDX	.	2	4	.	4*	.	3	.	4	.	.
LDY	.	2	4	4*	.	.	3	4	.	.	.
LSR	2	.	6	7	.	.	5	8	.	.	.
ORA	.	2	4	4*	4*	.	3	4	.	6	5*
ROL	2	.	6	7	.	.	5	6	.	.	.
ROR	2	.	6	7	.	.	5	6	.	.	.
SBC	.	2	4	4*	4*	.	3	4	.	6	5*
STA	.	.	4	5	5	.	3	4	.	6	6
STX	.	.	4	.	.	.	3	.	4	.	.
STY	.	.	4	.	.	.	3	4	.	.	.

**Add one clock cycle if indexing crosses a page boundary.*

The timing is not too crucial because setting up a new scan line takes approximately 28 cycles. From our example, we can calculate that nine NOP actions represent 18 cycles. This means we have to add between 18 and 46 cycles. If the following liners are moved to replace the NOPs, the program should run as if nothing has changed:

```
LDA # ROUTINE1&255 ... 2 cycles
STA LO.VECTOR ........ 4 cycles
LDA # ROUTINE1/256 ... 2 cycles
STA HI.VECTOR ........ 4 cycles
LDA # RASTER1 ........ 2 cycles
STA $D012 ............ 4 cycles
                  Total=18 cycles
```

To get both sets of characters on the screen at the same time means indulging in a little emulation. This may seem like cheating but a little study of the ROM handling will reveal the reasons why the technical white lie is necessary.

The VIC chip can only access one 16K block of memory at a time. This not only applies to the screen but also to the character set. On power up the screen is situated at $0400 but the character ROM lies at $D000, well over 16K away. To allow the VIC to 'see' the ROM, the operating system places an 'image' of the ROM at $1000. This image is invisible to the user but essentially very real and necessary to the operating system of the computer.

All we do with the supplementary Listing 2 is to physically transfer the ROM characters to the lower section of memory where its image normally lies.

Having done this, the two routines have to be altered to switch between the 'capitals' characters and the lower case ones. This is done by altering location $D018 which acts as a character pointer. How this works does not concern us yet, it will be the subject of a later section of this series.

Next, enter Listing 3 and then run it. You will see two capitals blocks but press any key and the bottom set changes to lower cases. Now we have both character sets displayed at the same time.

Move the cursor to the bottom line of the screen and continue pressing down the cursor until the first line of the bottom block lies on the screen split. Now you can see that my 'arbitrary' split value was not so arbitrary after all!

What you should see is that the top half of the letters are in capitals while the bottom half remain in lower case.

That's as far as I am going during this session but next time I'll be concerning myself with smooth scrolling and the tricks that all this can open up to the programmer. YC

See listings on page 77.

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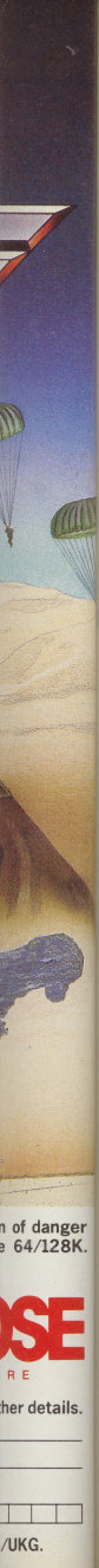
REMEMBER all features are built in and available at the touch of a key. All features work with both **TAPE** and **DISK.** (Except multipart transfer & disk file utility).

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BobsTerm Pro

A close look at what could be the ultimate C64 communications program.

By David Janda

BobsTerm Pro (BTP was produced in the United States by Bob Lentini, a leading authority on Commodore communications. The package is being distributed in the UK by Precision Software who are best known for their Superbase and Superscript packages.

To refer to BTP as comms software would be a bit of an insult. BTP is a complete telecommunications environment that incorporates almost every facility you could hope for. I say 'almost' because the package was written for the American market, and as such there are a few facilities that we would not use here in the UK – the Punter file transfer protocol being one example. Having said that, the few inconsistencies that I noticed do not affect the overall performance of the package.

User Friendly

BTP is a complex package, yet easy to use. This is because the author has opted to make BTP completely menu driven. Not the best user interface when compared to something like Amigas Kickstart, but it's very fast and effective in use. All the menus are well laid out and it was immediately apparent that a lot of thought went into the design of the menus. Presenting a screen full of detailed information such as the XMODEM transfer characteristics in a clear, easy to read format is not an easy task, but BTP succeeds in this respect.

The menus are in a hierarchical form with the main menu at the 'top' with sub-menus leading from it. Most of the commands are of the single key type with the letter corresponding to the action, e.g. pressing the Commodore key with E will toggle the echo. There are 19 such commands which are called comkey commands, and pressing 'K' from the main menu will list them with their associated functions.

Features

There are three methods of entering terminal mode in BTP, by pressing 'T' from the main menu, from the auto menu after dialing a number, or from the auto menu in answer mode. Once in terminal mode you are presented with a blank screen with five status lines at the top; the first of which is used to display various comkey settings e.g.:

CR:BFXXXXX:E:LI:LO:C:F:ASC:^
:0:hh:mm:ss

BF will show how many characters free there is in the buffer (which starts off at 28,500 bytes), E indicates whether echo is enabled and so on. Options that are enabled have their corresponding letters displayed in reverse video, and all the comkey commands are accessed by pressing the Commodore key followed by a letter (Table 1).

The next line consists of 40 dashes or a double row of dashes depending on whether the modem is on or off hook, and the following two lines are used to display various messages when transfering files. If anything drastic happens, such as an aborted file transfer, a flashing message will be displayed on the next line.

Communications is carried out on the following twenty lines by forty characters with the option of entering text in a two line window. This is very handy for those who like to play online adventure games or use real time chat facilities because the entered text will not be broken up by any incoming text.

One comkey command of particular interest is the word wrap feature. When enabled, text entered by the user will be formatted. Likewise, text being sent from the host system will also be formatted and this feature proved to be most useful when using BBs that are set up for 80 column output.

The terminal mode and the rest of BTP has a couple of cosmetic features. If you don't like the character set that is used then you can select another from a choice of seven more, and you have the ability to define your own. The colours used for text, error messages, menus and so forth can all be individually changed as well.

TABLE 1 — COMKEY COMMANDS

A — ASCII/BINARY
B — BUFFER
C — CAPS LOCK
D — DISPLAY TRANSFERS
E — ECHO
F — SCREEN FORMATTING
H — HOOK TOGGLE
I — LINEFEED IN
O — LINEFEED OUT
K — FUNCTION KEY LIST AND EDIT
L — LINE/CHAR ENTRY MODE (TERM MODE)
N — NULL STRIP (TERM MODE)
P — PRINTER ONLINE (TERM MODE)
R — RESET TIMER
S — SET TIME/START-STOP TIMER
T — TIME/TIMER TOGGLE
X — XFER FILES (TERM MODE)
@ — DISPLAY CTRL CHARS
* — CLEAR SCREEN (TERM MODE)

Buffering

Most packages have some sort of buffering facility which can be used to grab text that is being sent from the host system. With BTP the concept of buffering is taken much further. You have the option to SAVE/LOAD to/from disk or RAM, alter the buffer with a complete array of editing commands that would put some word processing packages to shame, and much more. BTP does not limit the buffer to ASCII use only. Basic programs can be automatically converted to ASCII when loaded into memory and sequential listings can be converted into Basic programs. A host of other conversion formats are available, and BTP enables you to define your own!

A detailed spiral bound user guide that's over 100 pages in length describes very clearly every aspect of the package. A section is devoted to each feature and the six page contents ensures easy reference. The guide is roughly divided into three sections; the first part covers getting started (for the impatient), next follows a detailed description of the package and the remainder of the guide covers parameter setting.

Compatibility

Before I detail BTP's features it's worth noting what the package cannot do, and the features that probably will not be of use to UK users.

First, BTP only works with modems that are connected to the user port, or modems that are interfaced with an RS232 converter which in turn is connected to the user port. This rules out the UK Commodore modem (commonly referred to as the Compunet modem). BTP contains a number of 'drivers' and is configured to work with the following modems:

Commodore 1650 Automodem;
Commodore 1660 Modem/300;
Commodore 1670 Modem/1200;
Westridge Modem;
Master Modem;
Mity-Mo Modem;
Hes I and II Modems;
Total Telecom Modem;
Hayes Smartmodem.

Most of the modems listed are not available here in the UK. This is not a problem though as BTP will work with any manual modem that's connected to an RS232 interface. However, unless you have one of the intelligent modems listed, or a Hayes compatible modem such as the Pace Series Four you will not be able to make use of the auto-dial features of the package. Demon/Voyager owners will not be able to auto-dial with BTP as these modems auto-dial by toggling the RTS line which is rather unconventional. Having said this it should be possible to make use of the auto-answer feature of these modems as long as pin eight on the RS232 converter is connected.

BTP allows pulse or tone dialing. The tone dialing feature is created by feeding the autio output of the C64 pack into the modem, but this feature is redundant because the UK System X dial tones are different from those used in the States – enough said.

Two other points worth noting are the Punter file transfer protocol and repeat dialing. BTP provides a number of file transfer protocols from straight ASCII to XMODEM (which is widely used throughout the UK). The Punter protocol is quite common in the US but not so here. However, I understand that a number of European Commodore Bulletin Boards will soon be using Punter, and if you should dial direct to the States it will no doubt be of use!

On a more serious note, BTP allows for repeat dialing. That is, when a number is auto-dialed and the host at the other end of the line does not answer BTP will continuously try the number over and over again. *Your Commodore* would like to point out that it is currently illegal for modems to repeat dial more than four times in succession, and as there is no facility to limit the number of re-dials (a bad point) this feature should be used with caution.

The Clever Stuff

The auto mode in BTP is used with one of the intelligent modems that is supported by BTP or a Hayes

compatible modem. From the auto mode menu you can enter a phone number and BTP will send the necessary command string to the modem to get it to dial the number. In answer mode the package will wait for an incoming call, answer the phone and display a welcome message which can be defined by the user. A neat feature is the ability to set up a password, thus offering a degree of security.

No doubt there are many similar sets of commands that you use when loging onto a BB or database. BTP allows the user to define a series of operations, called macros, that can be executed manually or automatically. Basically, a macro can consist of any BTP command, be it menu level, a comkey command or text that you would enter in terminal mode. The macro facility also has a degree of program control, so it's possible to detect whether certain characters have been sent by the host, and if so perform another set of commands. The macro commands can be executed manually or automatically by setting a time when they should be executed. I had great fun defining a macro to dial Telecom Gold, enter my ID and password, check if there was any mail, spool it to disk if so and log off, or log off if there was none – all done when I was down the pub!

It's not as easy as it sounds though, and I wish BTP had more sophisticated macro commands. As it is, the present commands are rather limited.

As I have mentioned before, BTP is a sophisticated telecommunications package, yet it's easy to use. Even though the package is loaded with features,using it is simplicity itself, and if you use the phone book option which dials a set number each time it is executed things are even easier. For example, from the main menu, connecting to a BB or database can be as little as three key presses away; this ease of use is by far BTP's strongest point. The menu system and excellent manual enabled me to use the package straight away with no problems whatsoever which is ideal in a comms environment. No comms package can offer a set of pre-defined settings that will see you through all possibilities. BTP offers some, but it also allows the use to tailor just about every aspect to their own requirements and save them as default settings.

In simple terms, BobsTerm Pro is the best piece of terminal software I have used on the Commodore 64. Its powerful features match and supersede those found on many professional PC based comms packages, and at £24.95 it represents excellent value for money. YC

Touchline:
Name: *BobsTerm Pro.* ***Supplier:*** *Precision Software Limited, 6 Park Terrace, Worcester Park, Surrey KT4 7JT.* ***Tel:*** *01-330 7166.* ***Machine:*** *C64/128.* ***Price:*** *£24.95.*

Sprite Library

Continuing our Sprite Library series, this month we look at the ways of producing different types of vehicles.

By Mike Benn

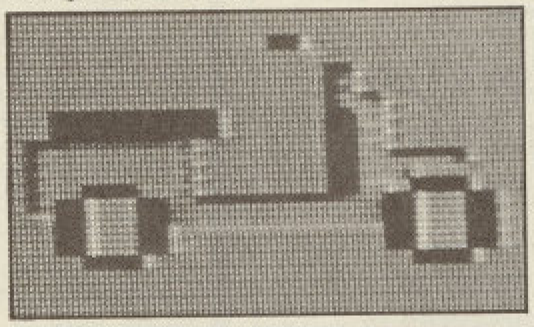
This month's addition to the Sprite Library will be helpful in the area of scrolling backdrops. The vehicles listed in the table require multi-colour mode and each definition needs two sprites per vehicle. Each vehicle is made up of four blocks of sprite data – the first pair being a side view and the second pair depicting a birds eye view. All the traffic faces right so if you need any of the vehicles facing left they will need to be manipulated by a suitable sprite editor.

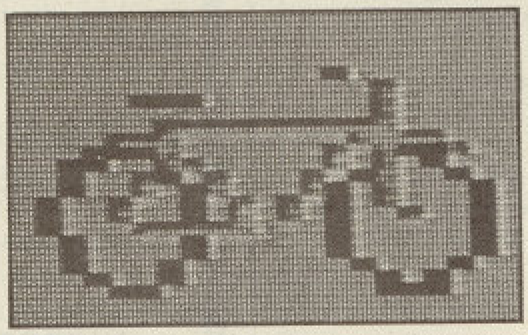
Table (Vehicles – Multi-colour)

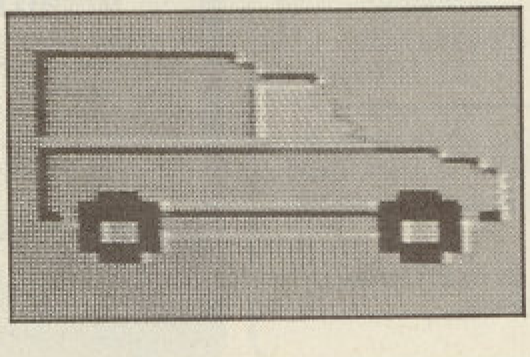
Hex		Decimal	Description
A0-A3	/	160-163	Bicycle
A4-A7	/	164-167	Tandem
A8-AB	/	168-171	Scooter
AC-AF	/	172-175	Motorcycle
B0-B3	/	176-179	35 CWT Van
B4-B7	/	180-183	Light van
B8-BB	/	184-187	Land Rover
BC-BF	/	188-191	Light pickup
C0-C3	/	192-195	Jeep
C4-C7	/	196-199	Estate car
C8-CB	/	200-203	Small hatch-back
CC-CF	/	204-207	Saloon car
D0-D3	/	208-211	Sports car
D4-D7	/	212-215	Porsche
D8-DB	/	216-219	Racing car
DC-DF	/	220-223	Taxi cab

Getting it all in

Type in the basic loader as published and *save it-don't run it* or it will self-destruct. Before running the loader program you will need to reset the computer and type the following:







POKE43,0:POKE44,64:POKE16384, 0:NEW and press return. This will trick the computer into believing that the Basic now starts at $4000 instead of $0801. Load in the Basic loader and run it; if error free, the program will automatically save itself as a block of data. If you reload that data in the future remember to add a 1 after the device number. The data is saved in the following location $2800-$37FF.

The sprites run from 160 to 223 in a compromise to avoid the area of $2000 traditionally set aside for redefined character graphics and to avoid the need of typing in line after line of data.

If only one or two sprites are required then use this formula: < Sprite block No.-160 > *40 + 190= the data line number at which that sprite blocks data starts. Remember to type in the following three lines of data and alter the variable BL to the number of data lines you have in your finished program, less 1.

The small basic program Vehicles Display will print the sprites variously in expanded form on the screen in both side and top views simultaneously. To hold on any sprite enter the same number for Start and End.

Any Sprite Editor program will enable you to change and adapt the individual sprites to your own requirements.

See listings on page 77.

KE16384, This will ieving that 0 instead of loader and ogram will a block of data in the 1 after the aved in the 37FF.
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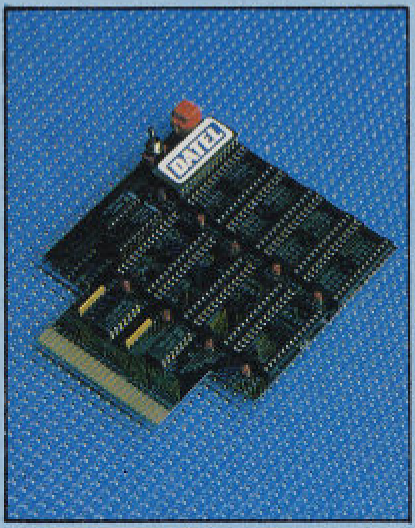
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YC

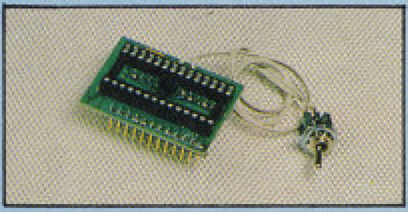
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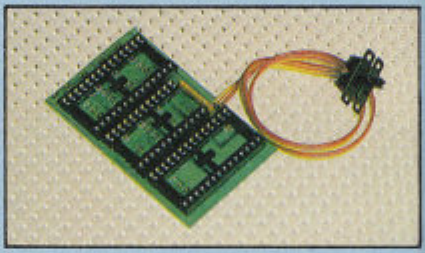




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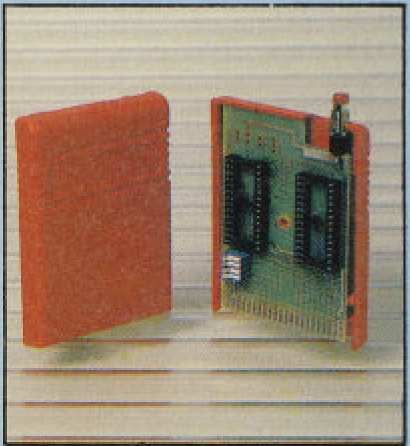
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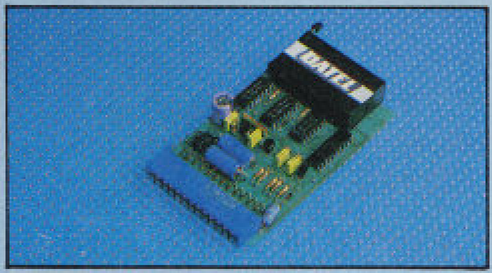
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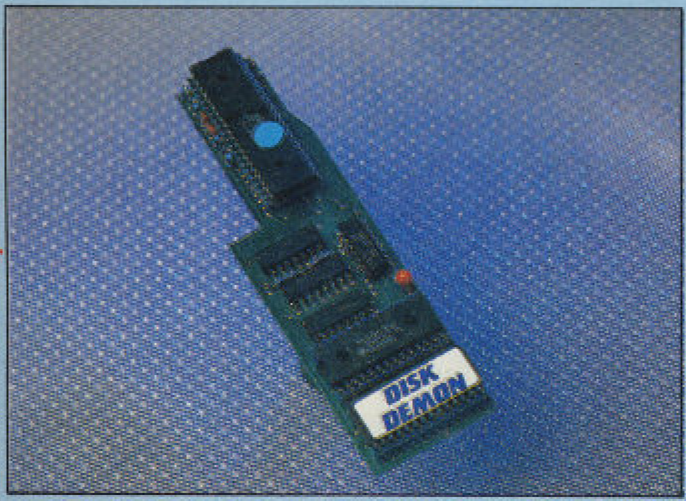
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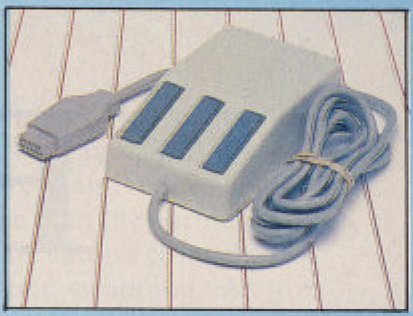


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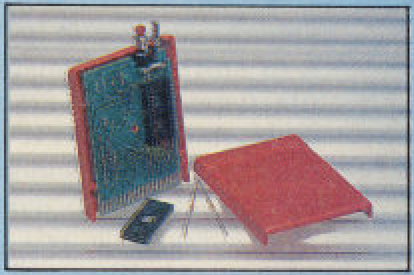
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Bothersome Basic

The old truism garbage in, garbage out is still relevant today, especially when using the INPUT command.

By Norman Doyle

One of the most common reasons why a program crashes is through unexpected responses when the user has to input some data through the keyboard. Trapping these unorthodox entries not only calls for an alert programming mind but also for a rethinking of the whole situation.

The problem with the Basic INPUT command is that it runs according to its own rules. This is fine if the users understand what these conditions are but not very forgiving if they don't. If the input is stored as a string variable the problems are easily rectified but using a numerical variable causes real problems.

String inputs which take up less than two screen lines will rarely cause problems as long as the string does not include a comma or a colon. Either of these symbols act as a terminator and only that part of the entry before the first occurrence of one of these symbols will be accepted as input, the rest is ignored. The computer responds to an incomplete acceptance of the attempted input with a rather unfriendly EXTRA IGNORED message.

A simple program such as;

```
10 INPUT"ENTER MESSAGE": A$
20 ?A$
```

would respond to an input such as:

I,MASTER OLIVER TWIST, WANT MORE

in the following way:

```
?EXTRA IGNORED
I
```

If the user made a mistake and went berserk with the delete key so as to totally erase the ENTER MESSAGE prompt, further chaos would result with the following response:

```
?EXTRA IGNORED
R TWIST
```

The part typed over where the original prompt was up to the cursor's old starting position has been ignored, as well as the extra piece after the comma.

The number of characters typed as an input can also cause problems. If the input continues beyond two screen lines and onto a third, only the characters on the third line will be accepted and no error message will appear.

The only way around this is to get confirmation of each entry with a check routine such as:

```
10 INPUT"ENTER MESSAGE",A$
20 ?"PLEASE CONFIRM THAT
   YOUR MESSAGE WAS:":?
30 ?A$:?
50 ?"PRESS 'Y' OR 'N' "
60 GET R$:IF R$="Y" GOTO 90
70 GET R$="N" GOTO 10
80 GOTO60
90 REM REST OF PROGRAM
```

Of course this only confirms or denies that the entry was correct. A total novice might keep trying to type in the same message until boredom and frustration sets in. The only foolproof way out is to give specific details of what can and can't be done when an error is confirmed. Quite a painful and dull way to write an interactive program.

As if this wasn't bad enough, numerical variables can be worse! At least the incorrect string inputs don't result in the termination of the program. With an interactive maths program it's always tempting to enter very large numbers. Try entering a vast number into this program:

```
10 INPUT"ENTER A NUMBER":A
20 ?A
```

As the number increases it is eventually treated as an exponential value such as 1.2345E+30. If this exceeds the maximum number that the computer can deal with (1.70141884E+38), an OVERFLOW IN LINE 10 error will be generated and the program will crash out and return to

the READY prompt and direct keyboard control. Not very impressive in a complex accounts program.

This can only be avoided if the number is entered as a string such as A$ and then evaluated and stored as a numerical variable, A, after complex processing. There must be a better way!

The best way, though long winded, is to use the GET command and build a string character. In this way *you* decide which characters may be entered.

First of all a suitable prompt message and a GET loop must be set up:

```
10 ?"ENTER MESSAGE: ";
20 GET A$:IF A$=""THEN 20
```

Now we need to print the characters on the screen as each is typed in and to store them as a separate string, B$:

```
5 B$=""
100 ?A$;:B$=B$+A$:GOTO 20
```

The difficult part is deciding which characters will be accepted and which will be rejected. First we'll assume that the message is going to be a mixture of numbers and letters (alphanumeric characters).

Every letter and number has a value assigned to it under a system known as ASCII (the American Standard Code for Information Interchange). CBM has its own version of this which is officially called Commodore ASCII (pronounced *askey*) but has commonly become known as PETASCII after Commodore's old range of computers which first used this system.

Under this system the numbers zero to nine have values from 48 to 57 and 'A' to 'Z' have values ranging from 65 to 90. The numbers 58 to 64 cover such things as the question mark, semi-colon and colon, so to make things simple, we may as well include those in acceptable range. Thus we get a range of 48 to 90.

This range does not include some other useful punctuation marks such as the comma, full stop or exclamation mark, nor does it include the value of 32 which represents a space. Fortunately these can all be incorporated by stretching the lower limit down to 32.

At this point we can use the *greater than* and *less than* facilities as follows:

```
80 IF A$<CHR$(32) AND A$>"Z"
   THEN 20
```

This means that each character is checked to see if its ASCII value lies between 32 and 90, if not it is rejected and the program leaps back to get another keypress.

With the program as it stands B$ can be stretched to hold 255 characters and no more. We need a delimiter which will stop any user from trying to type in more than that number:

```
90 IF LEN (B$)=255 THEN
   ?:?"MESSAGE TOO LONG.
   PLEASE TRY AGAIN":GOTO 5
```

There are kinder ways to do this but that will be covered in a later article.

The routine so far will work as long as the user types in the message correctly. What if a mistake is made?

First we must check for a DEL keypress. To jump to the routine for deleting the last letter from B$ and from the screen. Even the DEL key has a value assigned to it and this is 20.

If you enter ?CHR$(90), a 'Z' will be printed on the screen, similarly CHR$(20) will cause a deletion of a character. So we can easily complete one of the demands of correcting a mistake by using the CHR$ command:

```
30 IFA$< >CHR$(20) THEN 70
50 ?CHR$(20);
```

Obviously this deals with the screen but what about B$? It has to be dealt with using the string manipulation commands. What we need is to keep the left-hand side of B$ and disguard the last letter. Putting it another way we reduce the length, LEN(B$), by one. LEN(B$)=LEN(B$) -1 is an illegal command but

```
60 B$=LEFT$(B$,LEN(B$)-
   1):GOTO 20
```

will do the trick until LEN(B$)=0. A string cannot have a negative length and an error message would be generated if nothing were done. To trap this problem the following line will act as a filter:

```
40 IF LEN(B$)=0 THEN 20
```

The final stage of the line input routine is to check for a carriage return, ASCII 13, and exit to the rest of the program:

```
70 IF A$=CHR$(13) GOTO 110
110 ?:?B$:?LEN(B$)
```

Although this is better than the normal INPUT command, it's not perfectly foolproof and it does take up a lot more space than the normal input procedures. This can be compensated for by parameter swapping. As you can see from the slightly modified Listing 1, the routine is set up as a subroutine. If the main program avoids using the parameters mentioned (A$,B$) you can GOSUB to this routine. On RETURNing B$ can be simply renamed with a command such as NEWNAME$=B$ and the routine can then be called again for the next input later on.

For numbers the acceptable range needs only to be ASCII 48 to 57 with special allowances if decimal points, currency symbols or arithmetical operators are expected.

Evaluation of B$ would be a conversion to a numerical variable after first shortening the string to a manageable length for the computer to deal with. This is rather like deciding how many significant figures, and hence the degree of accuracy, of a calculation. In this way numbers in excess of 1.70141884E+38 can be rejected before the program tries to use them and subsequently crashes out.

The Deep End

For the more accomplished, the INPUT command can be forced to accept colons and commas by skillful trickery. Before using the INPUT command, quotation marks are placed in the keyboard buffer as though they had been typed there.

To do this ASCII 34 is poked into the first buffer byte at 631 and the buffer queue at 198 is informed that there's one character already waiting there. When the INPUT command is executed, the quotation mark is printed alongside the input question mark.

```
10 POKE 631,34:POKE198,1
20 INPUT"ENTER MESSAGE":A$
30 ?A$
```

I regret that I cannot answer your problems by phone but if you have any queries about Basic routines or about these articles, please send them to Bothersome Basic, Your Commodore, 1 Golden Square, LONDON W1R 3AB enclosing an sae and any relevant printouts or recordings. YC

Ackroyd's Saga

Let your computer take the strain of learning tables.

By Allen & Margaret Webb

In case any regular readers of my Teacher's Pet column haven't worked it out for themselves, I've got a pretty shocking confession to make. I am very old fashioned, both in the way I bring up my children and in their education. I believe in old fashioned virtues of politeness, honesty and respect for one's elders and those old hat school subjects of spelling and learning tables. Both of these have been out of favour; the former because it was believed that it stifled creativity, the latter in some cases simply because the diversity of the curriculum pushed these subjects to the bottom of the pile. Luckily the primary school that both of my children attended believed that learning tables was important and table tests were a regular occurence.

A look around the shops will confirm the need for mental arithmetic and multiplication tables. How many times have you watched as simple calculations have been worked out on scraps of paper or the ubiquitous calculator when they could have been computed just as quickly in the brain?

Improving Numeric Skills

Ackroyd's Saga is the first of two games aimed at helping the learning process of mental arithmetic skills. In the game, the 0 to 12 times tables are tested. The nought times table is included since it is a difficult concept to grasp. In the game, you play the role of a trainee knight searching for the parts of the key which will let you into Ackroyd's castle. (Ackroyd is the usual evil king.) On your way to the castle you will encounter various nasties. You must fight these if you want to get passed them, and 'fighting' involves answering tables questions. You answer an odd number of questions. If you get more correct than wrong, you win.

There are five levels in the game with each level posing questions on different tables. The easiest level deals with 0 to 3 times tables, the most difficult deals with 0 to 12. In addition, the levels give you different times to respond. The default values give ten seconds at the easiest level and six seconds at the top level. You can change the times and number of sums if you wish by choosing the edit option in the game loader.

The game is controlled by a joystick (in port 2) or keyboard (S: moves south, E: east, N: North, W: West). To answer questions you simply type in the answer and press Return. Delete will clear any mistakes.

LOADER	SAVE name	Start Address	Finish address
1	SPRITES	12288	14784
2	CHARSET	10240	12287
3	HOUR-GLASS	8192	8920
4	OBJECT.1	6144	7573

The game comprises six modules. To convert the loaders to useable code, use the following procedure:
Type in POKE 44,64: POKE 64*256,0:NEW
LOAD and RUN the loader
LOAD and RUN the Code Saver routine using the details given in the table. You don't have to use the suggested names but if you don't, you must amend the BASIC portion accordingly.

Once you have completed this procedure for each loader, you can test them by LOADING them all (don't forget the secondary address... LOAD "name",8,1 or LOAD "name", 1,1). And type in the line:
SYS 6144:SYS6153

You should get the display and be set a question to answer. If this happens, all is well.

The BASIC program controls the whole program. You should note that the first portion assumes that you are loading from disk. Cassette users must change the device number.

The game play is quite simple. The knight walks in the direction you specify. If you use keyboard control, auto repeat allows you to hold the keys down. When you reach the edge of the window, the next part of the map is displayed. If you enter a square with a nasty, you must fight. If you win, the nasty vanishes. If you loose, you are dumped on the last square you were on. If you enter a square with a part of the key, it is automatically yours. Find all four keys and reach the castle door and the game ends.

Now we will complete the loaders and show you how to run the game. The last two loaders are converted to code as before but with a slight difference:

Type in POKE 56,128: CLR
LOAD and RUN the loader
LOAD and RUN the Code Saver routine using the details given in the table.

To play the game, reset the computer by turning it off and and on or by using SYS 64738. You then just LOAD and RUN the BASIC portion.

Next time we will give a map of the game and an editor which will allow you to change the locations of the key parts and the nasties.

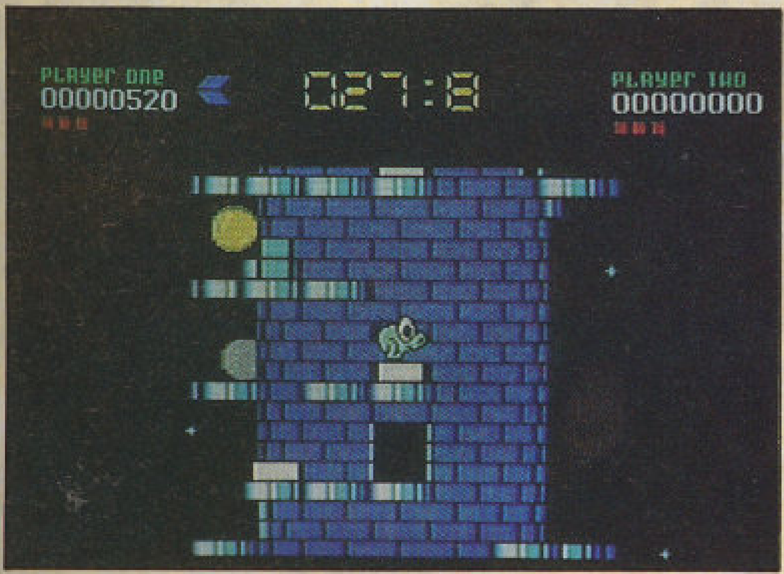
LOADER	SAVE name	Start Address	Finish address
5	OBJECT.2	32768	36176
6	MAP	36864	40545

See listings on page 77.

Games Reviews

For the latest on the shoot 'em up front, consult our review pages.

Que-dex



Inspired by Gremlin's Bounder, Que-dex is an arcade game in which you must look before you leap if you're going to get to the top of the high score table.

Que-dex consists of ten tracks of planes that can be attempted in any order but only the very brave or stupid dive straight into plane ten.

In plane one you simply have to complete a series of exercises that will prepare you for what's to come. In the other planes you must reach the GOAL before the time runs out. To get to the goal you will have to negotiate a maze, travel long lifts and through teleports, avoid ground that drains your time and areas that just disappear leaving you on the way to oblivion. You will have to get around locked doors that are opened only by finding specific keys. To add to your problems some keys remain invisible until you're next to them, and are usually next to a killer Skull and Cross bones, where one wrong move will cost you that game.

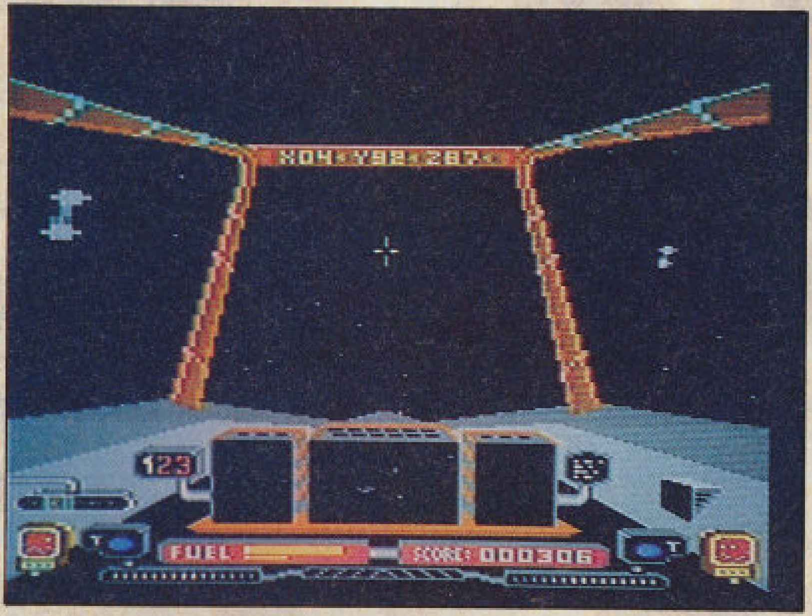
However, you can get some help from objects you can pick up such as amulets that reveal the GOAL and objects that give you extra speed or more time and sound surprise features that may help or hinder you.

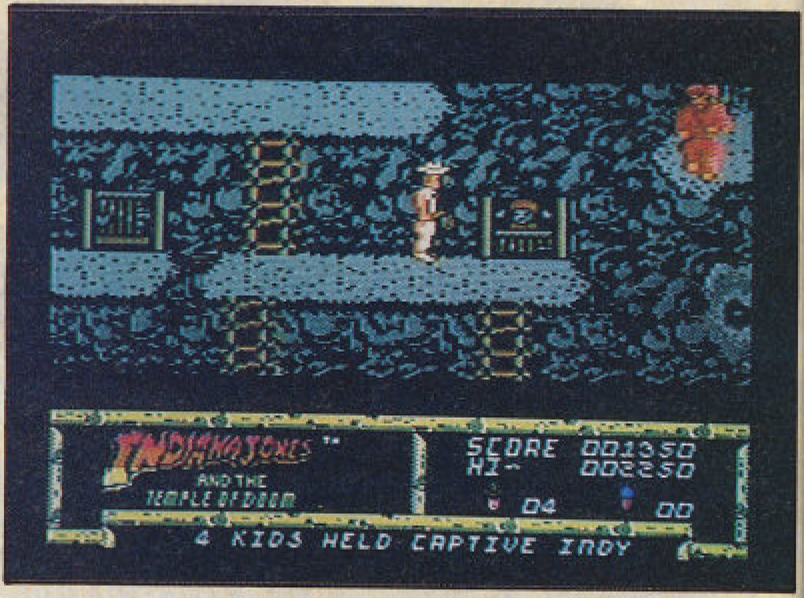
At the end of each plane you have a chance to pick up some extra points in a bonus screen and a chance to rest before attempting the next plane. This game would be tough enough without the time limit, with it, it's almost impossible. T.H.

Touchline:

Title: *Que-dex.* ***Supplier:*** *Thalamus, 2 Minerva House, Calleva Park, Aldermaston, Berkshire RG7 4QW.* ***Machine:*** *C64.* ***Price:*** *£9.99 (C) £14.99 (Disk).*
Originality: *7/10.* ***Graphics:*** *7/10.* ***Playability:*** ***âa28/10.*** ***Value:*** *8/10.*

Starfox





In the unofficial sequel to Skyfox you are Hawkins and your mission is to destroy the aliens that have invaded the protective Rubicon cube that surrounds eight planets.

The standard Starfox is equipped with a turbodrive that will send you hurtling through space but will also drink fuel at an alarming rate and a standard laser. However, you can improve your chances and your craft by docking with motherships that orbit the eight planets and choosing from the selection of weapons that include energy bolts, shockers and more powerful lasers.

You'll need this extra weaponry to wipe out the invading convoys of aliens that come at yоu ten at a time. If you haven't got the right weapon you may have to shoot each alien four times to destroy it.

The aliens don't actually fire at you but they do exhaust your fuel supply which will cost you the game. You can refuel at a planet or from a refueling ship but only if you can find one in time.

Starfox is a game that will require its players to invest some time in it before they become hooked. Once they've completed a few levels (this will take some time) they will become hooked by it.

Touchline:

*Title: Starfox. **Supplier:** Reaktor, 9 Disraeli Rd, Putney, London sw15 2DR. **Tel:** 01-785 4285. **Machine:** C64. **Price:** £9.99 (ca) £12.99 (Disk).*
***Originality:** 5/10. **Playability:** 5/10. **Graphics:** 5/10. **Value:** 6/10.*

Indiana Jones and the Temple of Doom

Indiana Jones is set to burst onto the small screen in the C64 conversion of the Atari coin-up version of the film.

Armed with just his trusty whip Indy must fight off thuggee guards and snakes as he attempts a three stage game. In part one he must rescue children trapped in cages by whipping the locks off. These cages are spread throughout a cave network linked by ladders and ledges as well as posts that our hero can attach his whip to and swing across Tarzan style. If he manages to free all the children he can escape in a mine car and into part two.

This is the shortest part of the game and is simply a ride in a mine car down a broken track. When you come to a break in the track leaning over will avoid disaster, but may bring you into range of the Thuggee guards or into the path of the pursuing car. This is an all or nothing stage as taking a wrong turn will cost you a life but once you've learned the route it couldn't be easier.

At the end of the track you enter the Temple of Doom and can attempt to retrieve one of the Sankara stones. Once again you're attacked by thuggee guards and slithering snakes but if you get your timing right you can swing over the firey gourge, grab a stone and escape only to find yourself back in the caverns with more children to rescue.

As a conversion the game is reasonably close to the original (although the music is terrible). Unfortunately, the original game rapidly became repetitive, and desperately needed three or four more lvels. A good conversion but there have been better games to convert. **T.H.**

Touchline:

*Title: Indiana Jones and the Temple of Doom. **Supplier:** US Gold, 2/3 Holford Way, Birmingham. B6 7AX. **Tel:** 021-356 3388. **Machine:** C64. **Price:** £9.99.*
***Originality:** 3/10. **Playability:** 6/10. **Graphics:** 5/10. **Value:** 6/10.*

Captain America

When America is threathened with total annihilation who do you call. Superman? Ghostbusters? No! This time it's Captain America – the defender of the Constitution who must save the day!

Dr. Meglomann, a man who the CIA claimed they killed in Cuba in the early sixties has emerged from hiding and claimed the Presidency of the US of A, and if power isn't handed over he'll fire a rocket packed full of killer virus at North America and wipe everyone out.

One hundred elite marines stormed the mad doctors base but were all killed by the deadly virus. Now you, Captain America must save the world!

The doctor is holed up in the tube of Doom and it's not going to be easy to get him out. The tube of Doom consists of three concentric tubes packed with laser firing robots. Your mission is to fight your way through all three levels to destroy the rocket, and bring Dr. Meglomann to justice. As the game begins you are sitting at the controls of the Orbivator, an elevator that runs between the outer and middle cylinders. From this you can gain access to the rooms of the tube of Doom.



The deeper you get into the tube the greater the level of the virus that will slowly overcome even Captain America's superhuman strength and so you must stay within your immunity range. You must also find a way to increase your immunity so you can explore these deeper levels.

Perhaps the answers lie in the rooms that you can reach by battling the robots in each level. Here you'll find more laser firing and homing enemies as well as a source for your Captain America shields (your only weapon) and maybe even a few clues.

Captain America is a massive arcade adventure in which your reactions will have to match your brain power if you're going to survive long enough to save the day. T.H.

Touchline:

Title: *Captain America.* ***Supplier:*** *GO!, 2/3 Holford Way, Holford, Birmingham, B6 7AX.* ***Tel:*** *021-356 3388.* ***Machine:*** *C64.* ***Price:*** *£9.99*
Originality: *7/10.* ***Playability:*** *7/10.* ***Graphics:*** *6/10.* ***Value:*** *7/10.*

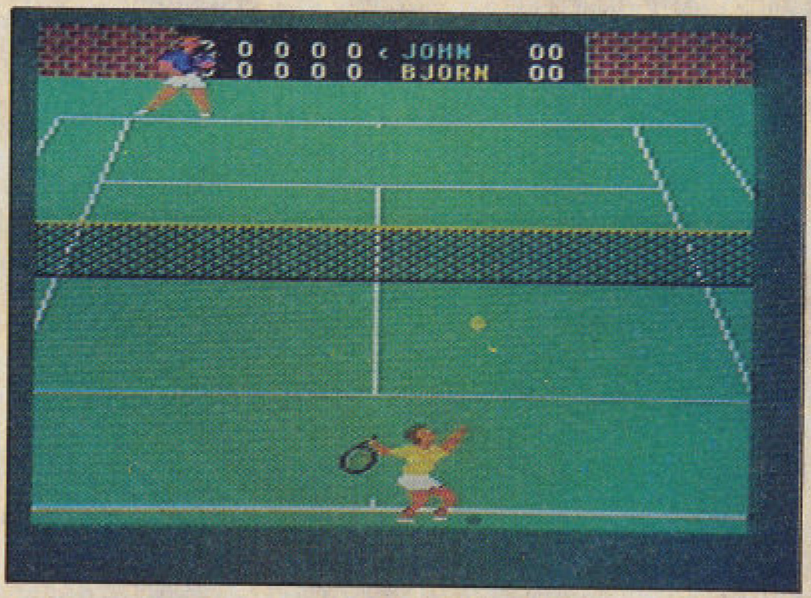
On Court Tennis

On Court Tennis is another of the Activision Gamestar games to be re-released by Firebird at a budget price. This time you can pick up your racket and stride out onto the centrecourt as Ivan, Bjorn, John or Jimmy to take on a computer or human opponent in a match lasting three or five sets.

As the players take their places on court the temptation is to write the game off as having poor graphics but gradually the addictiveness of the gameplay takes over. Even when you're 5-0 down you still think you've got a chance!

The game is controlled entirely by the joystick with it's movements deciding the strength and direction of the shot. This, of course, depends on how well you time your shots and whether you play the right shot at the right time. With that lot to think about it's lucky that the computer automatically moves you to the ball so you can concentrate on the shot.

The result is a tennis game that was over priced in the full-priced market, but at last as found it's right value for money. It's limited and at times not very pretty but as a cut priced tennis game it has the advantage. T.H.



Touchline:

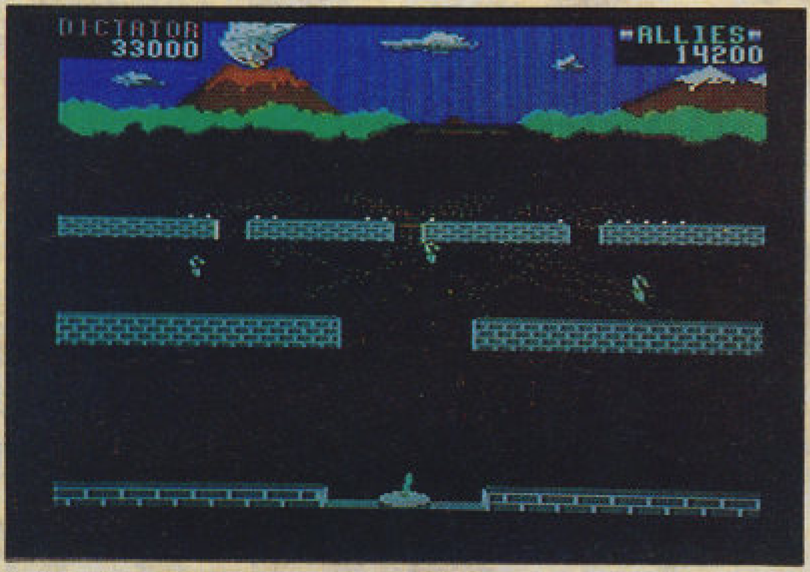
Title: *On Court Tennis.* ***Supplier:*** *Firebird, 64/76 New OOxford Street, London WC1A 1PS.* ***Tel:*** *01-379 6755.* ***Machine:*** *C64.* ***Price:*** *£1.99.*
Originality: *4/10.* ***Playability:*** *6/10.* ***Graphics:*** *4/10.* ***Value:*** *5/10.*

Beach Head II

Beach Head II, the game that shocked the world with it's realistic screams is back as part of Mastertronic's Americana range. In this, the sequel to the highly succesful Beach Head the evil, warmongering, bloodthirsty, power crazed maniac dictator known as the dragon is out for revenge and plans to destroy the forces that wrecked his fortress in the original game, that means you.

As in Beach Head, Beach Head II is a multi-stage arcade game, only this time you can play either side in a head to head contest.

The first sequence is a two part game with the dictator making a massive gun that tries to blast the good guys as they're dropped by helicopter behind the first line of defences. Once they've all been dropped you must bring



them forward while running the gauntlet of the giant gun. If they're hit, they let out a bloodcurdling scream or yell for a medic! As you approach the gun you can send one man over a wall while the gun will be destroyed but soon replaced so you have to move quickly.

In stage two you must rescue the men captured by the dictator by turning their own gun against them. This isn't going to be easy as the prisoners escaping across the court yard can be shot by men on walls, blown up by mines thrown out from trap doors, killed by a track or slowly and loudly crushed by a tank.

Part three is a Zaxxon style screen in which you must fly the escaped prisoners to safety in three helicopters, along as you can get past the Dragon's defences and finally in part four, your in man to man combat with the dictator in his underground caves. To win you must hurl pointed sticks at the villain and escape his deadly throws.

Beach Head II is a loud, action-all-the-way arcade games that won't win any good taste awards. **T.H.**

Touchline:

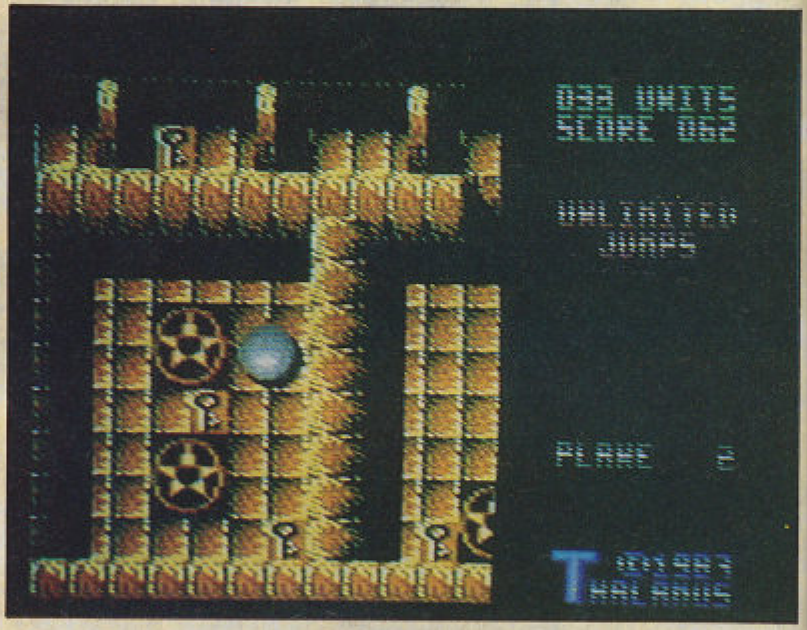
Title: *Beach Head II.* ***Supplier:*** *Americana, 8-10 Paul Street, London EC2.* ***Tel:*** *01-377 6880.* ***Machine:*** *C64.* ***Price:*** *£2.99.* ***Originality:*** *4/10.* ***Playability:*** *7/10.* ***Graphics:*** *4/10.* ***Value:*** *7/10.*

Nebulus

Nebulus is yet another incredibly addictive Hewson arcade game in which you, a cute little frog like critter, must destroy a series of unauthorised towers that someone has built in the sea. Your job is to climb up to the top of these towers and destroy them.

Unfortunately, this is going to be far from easy. You arrive by mini-sub at the base of the first of eight towers. Around it you can see a series of platforms and lifts that you must navigate as well as tunnels that lead from one side of the tower to the other. Each tower is also patrolled by a selection of nasties. Some can be blasted with your bubble gun, while others are indestructable and must be avoided at all costs. This isn't always easy when you're walking along platforms that disappear from under your feet, slide you backwards as quickly as you can run forward and gaps that are just further than you can jump.

It all adds up to a great game that adds new lease of life to the addictive platform game format. **T.H.**



Touchline:

Title: *Nebulus.* ***Supplier:*** *Hewson Consultants, Hewson House, 56B Milton Trading Estate, Milton, Abingdon, Oxon.* ***Tel:*** *0235 832939.* ***Machine:*** *C64.* ***Price:*** *£8.95.* ***Originality:*** *8/10.* ***Playability:*** *7/10.* ***Graphics:*** *7/10.* ***Value:*** *7/10.*

Action Force

When the evil enemy Cobra attacked the small island of Botsneda, the military installations were destroyed. All except the eastern part which contains some classified information stored on hard disk. This data must not fall into enemy hands. There just isn't time to organise a conventional force attack so they must send in the Action Force.



Lady Jay and Crankcase man the A.W.E. Sriker that has been quickly modified for data retrieval and so must be protected by you, Wild Bill, and Flint in the Dragonfly XH-1 helicopter.

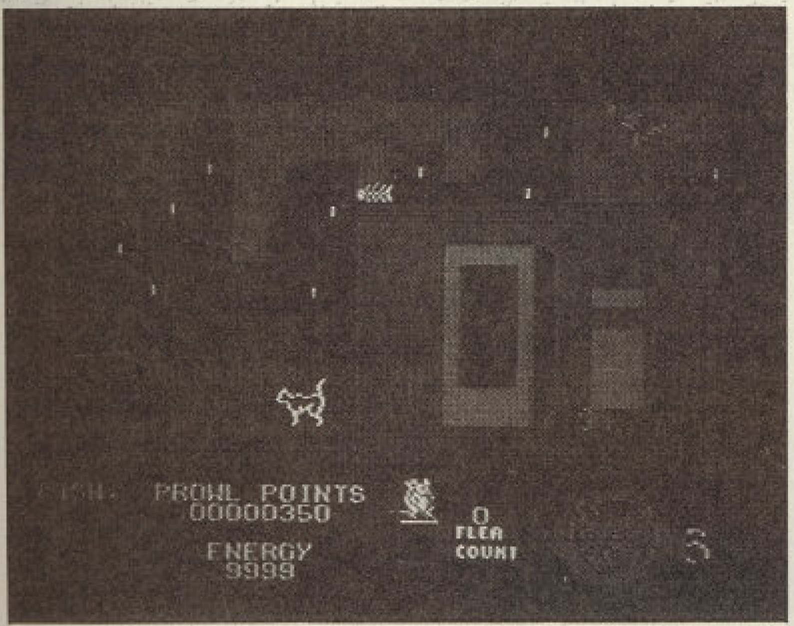
The enemy will bombard you with other helicopters, planes, guns and missiles that you must blast and avoid while clearing a path for Striker.

The result is a standard sideways scrolling shoot 'em-up with eight levels that may have some appeal for Action Force fans. Anyone else who wants helicopter action should take Gunship for a test flight. T.H.

Touchline:

Title: *Action Force.* ***Supplier:*** *Virgin Games, 2-4 Vernon Yard, Portobello Rd., London W11 2DX.* ***Tel:*** *01-727 8070.* ***Machine:*** *C64.* ***Price:*** *£9.95* – disk only.
Originality: *4/10.* ***Playability:*** *6/10.* ***Graphics:*** *5/10.* ***Value:*** *6/10.*

On the Tiles



Firebird and Odin present the first feline simulation in which you must prowl the streets in search of fish bones to gain control of eight streets.

Unfortuantely, all is not purrfect for our furry hero who must avoid the attentions of blood sucking fleas and the draining effect of frogs as well as the fatal touch of kitty hawks and hedghogs. Luckily, you can regain lost energy for grabbing a sparrow or mouse as you leap from window sill to rooftop.

You can protect yourself from things that cost one of your nine lives by spitting some green unnamed substance at them. However, at times you don't have time to react since you must press the space bar to fire which is never near enough to the joystick to save myself.

On the tiles is a good but tough game which features some nice animation and addictive gameplay. T.H.

Touchline:

Title: *On The Tiles.* ***Supplier:*** *Firebird/Odin, 64/76 New Oxford St., London WC1A 1PS.* ***Tel:*** *01-379 6755.* ***Machine:*** *C64.* ***Price:*** *£7.95 (C) £12.95 (Disk).*
Originality: *9/10.* ***Playability:*** *6/10.* ***Graphics:*** *7/10.* ***Value:*** *8/10.*

Super Sprint

Super Sprint is the latest coin-up conversion for the C64 and attempts to recreate the arcade racing game that's been an amazing arcade hit.

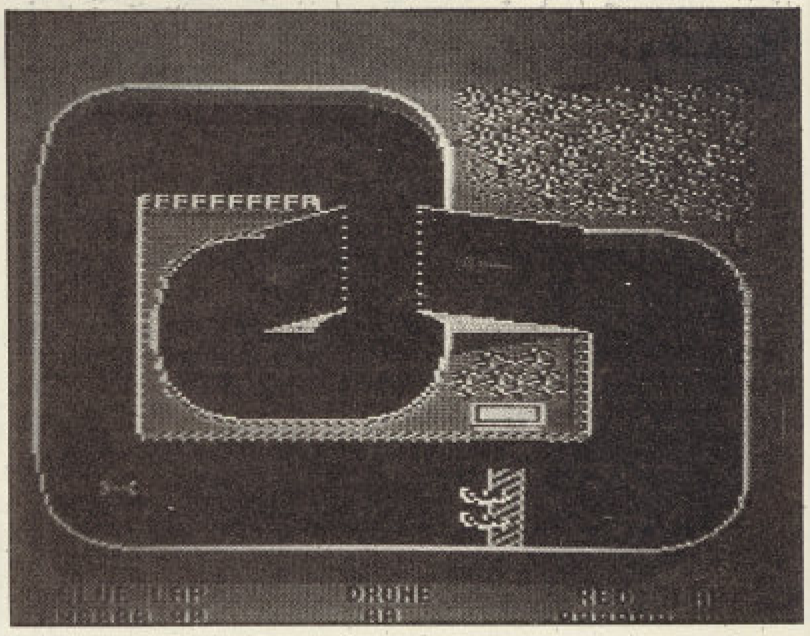
Unfortunately, it's impossible to get three players around a C64 and so this conversion has only a one or two player option with the remaining cars driven by drones. These drones never skid or crash but are easily beaten by a skillful player, but will wipe you out if you hurtle around every bend and end up in a smouldering heap. Your car is quickly replaced by one that arrives be helicopter but you will have lost valuable time.

Once you've selected one or two players (and if two either a head to head conflict or a normal super sprint) you can select one of the four tracks that feature tight bends, bridges that obscure your view and gates that open and close to allow you to take short cuts that could win you the race.

On the track you may also find oil slicks that will send you spinning, bonus points and accasionally gold spanners. If you collect three of these spanners in a race you can improve your car by adding super traction, turbo acceleration or a higher top speed or just improve your score with a score multiplier.

Whatever you choose even the experienced champions have to avoid the spinning whirlwind that gets you in a spin if you're caught in it's path.

Super Sprint is a good conversion that will drive racing fans round the bend as they attempt to build a car that can beat all comers. T.H.



Touchline:

Title: *Super Sprint.* ***Supplier:*** *Electric Dreams, Terminus House, Terminus Terrace, Southampton, Hampshire SO1 1FE.* ***Tel:*** *0703 229694.* ***Machine:*** *C64.* ***Price:*** *£9.95 (C)*
Originality: *4/10.* ***Playability:*** *8/10.* ***Graphics:*** *6/10.* ***Value:*** *7/10.*

YC

Teacher's Pet

Need some help with your studies? Then take a look at the latest educational packages. Learning can be fun!

By Margaret Webb

Following the dearth of new educational software over the last year or so, it's nice to have enough material to write another Teacher's Pet column. I want to discuss three packages which are all very different in subject matter. While the review copies all came on disks, there are no technical reasons to preclude their appearance on cassette. In fact, Biology, from Software Horizons, came with a cassette inlay.

'O'/GCSE Mathematics

The first package is written by Evelyn Mills, a name which should be familiar to regular readers of *Your Commodore*. This package covers some of the main areas of the 'O' level and GCSE syllabuses in mathematics. Extensive use of a graphics system called Video Basic 64 is used, which allows easy use of high resolution graphics, permitting the drawing of circles and lines and the use of fancy shadings and patterns which is used to enhance the appearance of the package and illustrate certain aspects.

The software covers six main topics which include:

Basic Mathematics.
Algebra.
Geometry.
Progressive Mathematics.
Trigonometry.
Linear programming and statistics.

A final section provides a selection of questions extracted from past 'O' level exam papers. In keeping with most exam based educational software, the material provided is more of a revision aid for use in conjunction with normal texts and tuition. To give you some idea of the content, I will run through two of the sections – geometry and algebra.

The use of high resolution graphics is put to best use in the geometry section. This section covers a number of topics which include circles, sectors, chords and tangents, plane shapes and polygons. The algebra section, on the other hand, requires less emphasis on graphics. The areas covered include law of indices, cross multiplication, removal of brackets, factorising quadratic equations and simultaneous equations.

The examination section is, as expected, faily testing and extends beyond the material given in the package. I think however, this is only to be expected.

All sections give a good mix of handy tips or rules of thumb and illustrative examples. There is, however, no error trapping, allowing ridiculous answers to crash the program. Some examples required input from the user – ensuring that he didn't fall asleep! Overall, the content is good and is presented in an interesting manner. Although it may sound carping, there was one irritating aspect.

All sections use Video Basic to generate fancy (and in my view) superfluous displays between topics. Some of these took some time to be drawn and became a little boring. My main objection is that these displays occupy valuable program space which could be used to better effect.

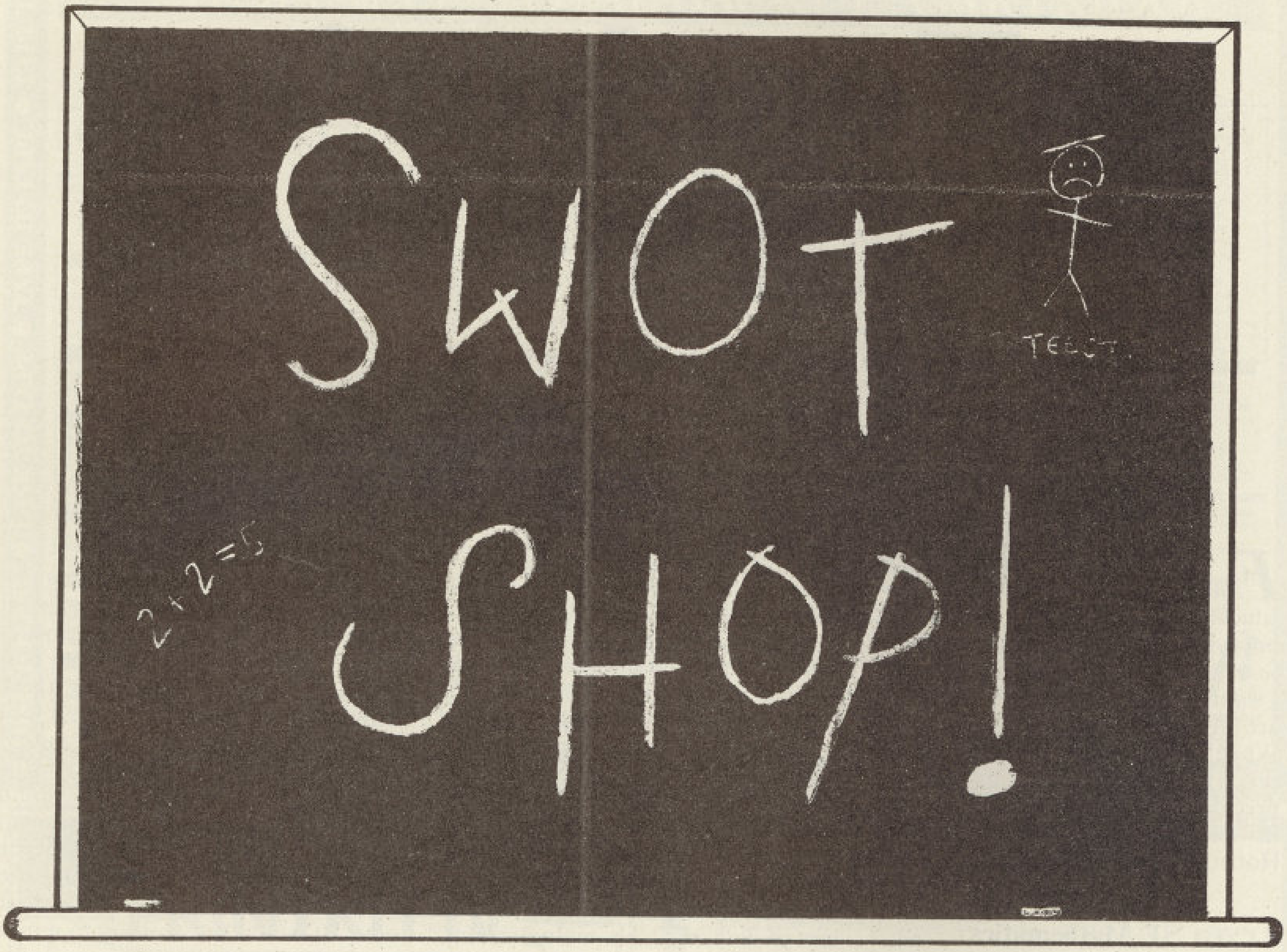
Notwithstanding this point, the disk is filled well with something like 130K of software on it. One final point is that the examination section expects you to work from the monitor. This won't present a problem for those using their own copy at home but is of little value in a busy classroom since it locks up a machine which could be otherwise used. A better idea would have been to provide an option to allow you to make a hard copy of the examination questions and so that the computer could be released for other users. It would be necessary to return to the machine for the answers.

History Package

The next offering comes courtesy of Duncan Bowen School, Ashford. This software uses the Quill adventure writer to create a novel approach to the teaching of History. History is usually a sure way to send pupils to sleep, as it is always full of dates, places and names and has as much life in it as a building brick.

The fact is that History is a living subject which involves people of all walks of life. By involving the pupil in the subject, it becomes live and interesting, and software uses the adventure concept to achieve this goal.

The disk contains two packages covering different aspects of the same problem. The main portion relates to an investigation of the past. The pupil has to "travel" around seeking information which will help solve a Victorian murder. To achieve this aim, you must examine a wide range of sources of information such as



records, diaries, memorials in churches and listen to the gossip.

In the first part you have to compile the basic facts from archival material. You have access to contempary material in the second part, and with this you attempt to form a case against the murderer. Two further parts provide further information and quiz your findings.

In the second package, the pupil has to explore a Kentish village and map it. The final aim is to compile as much information as possible about a family that lived there.

Overall, the main theme of the package is that there is alot of material available which is used to explore the past and shows where it is found and how it can be used. The software is detailed and well thought out – the documentation is copious and extremely useful; providing teacher's notes and help for the pupils. The material is ideal for project work, both for groups of children and the individual. I believe that this software is free provided that a blank disk or tape is sent.

Revision Series

Finally, I received some sample extracts from a series, written by Software Horizons, whose software is very much of the subject summary/revision genre. The system uses a kernel of routines which perform some fixed actions on a database. The database is specific to each subject. The format is text only with choices made from menus.

Each topic has a block of notes occupying two or three screen loads, which must be read in conjunction with normal notes. There are then a number of questions aimed at testing the pupil's knowledge. These are:

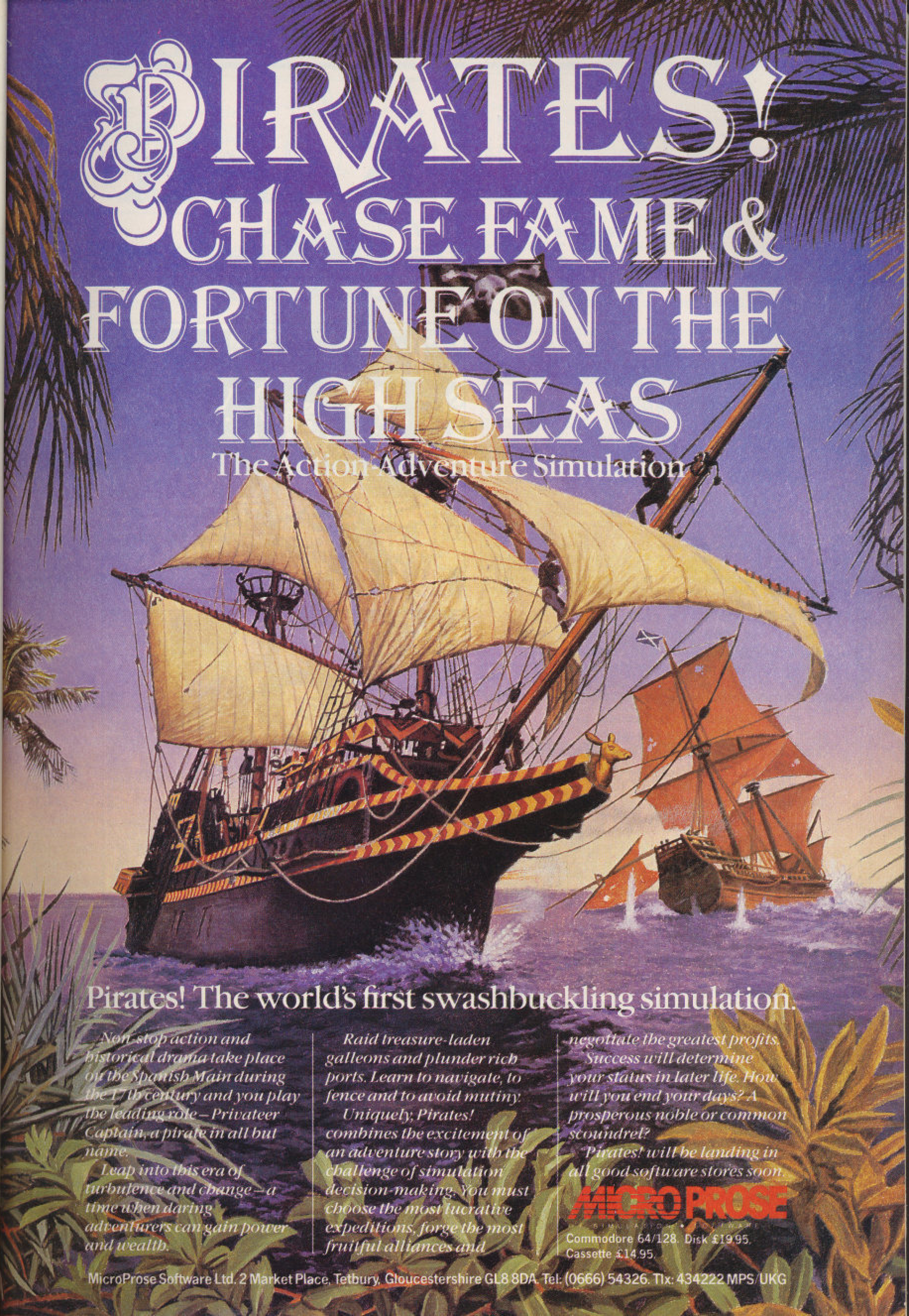
Single question: these simply require a typed answer to a question.
Multiple choice: three possible answers are given for the pupil to choose from.
True or false
Group questions: answers are chosen from a given selection to answer a group of questions.
Time test
Fill in paragraph: the pupil has to insert the missing keywords into a paragraph.

A nice touch is the program's ability to tolerate minor deviations in spelling. Overall this package does its job well, but due to the lack of graphics, is rather unexciting.

Touchline:
Title: *'O'/GCSE Mathematics.* ***Supplier:*** *Adamsoft, 18 Norwich Avenue, Rochdale, Lancs. OL11 5JZ.* ***Price:*** *£12.95.*

Title: *History Revision.* ***Supplier:*** *Mr J. Fanning, Duncan Bowen Youth Wing, Duncan Bowen School, Stanhope Road, Ashford, Kent.* ***price:*** *Free of charge.*

Title: *Revision Series.* ***Supplier:*** *Software Horizons, The Mall Centre, Main Street, Wicklow Town, Co. Wicklow, Eire.* ***Price:***

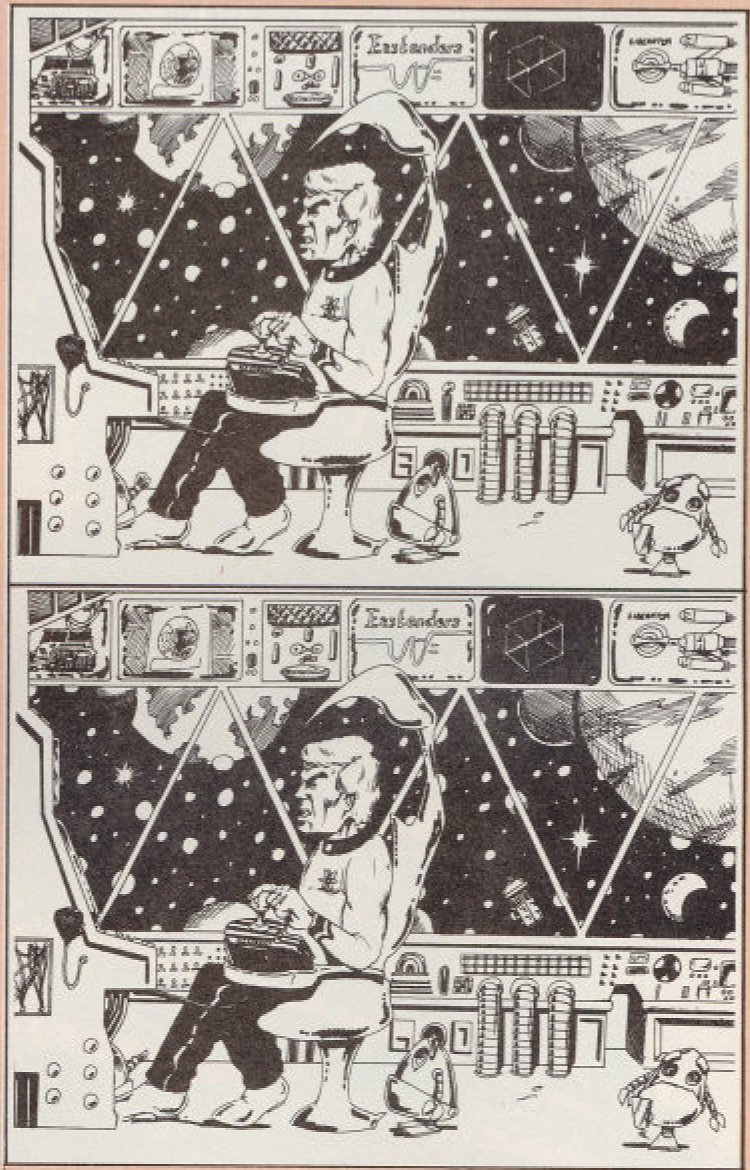

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MicroProse Software Ltd. 2 Market Place, Tetbury, Gloucestershire GL8 8DA. Tel: (0666) 54326. Tlx: 434222 MPS/UKG

Win a Konix Joystick

Konix is set to launch a new joystick onto the market. We're giving ten away as prizes in this month's competition.

The Konix joystick is probably the one of the best known joysticks available. Now Konix is set to take the market by storm once again with a new version of the joystick, now with an auto fire facility.

Your Commodore is pleased to team up with Konix for this month's competition. We are giving away ten auto-fire joysticks to the first ten correct entries pulled out of the hat after the closing date.



How to Enter

Study the two cartoons, there are a number of differences between them. Once you have decided how many differences there are complete the entry coupon and send it to the editorial address (see below). Please write the number of differences that you have found on the back of the envelope. If you don't then your entry will not be accepted.

The Rules

Entries will not be accepted from employees of Argus Specialist Publications and Konix. This restriction also applies to employees' families and agents of the companies.

The How to Enter section forms part of the rules. The Editor's decision is final and no correspondence will be entered into.

Konix Competition Entry Coupon

Name ....

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Number of differences found ....

Post to: *Your Commodore*, Konix Competition, 1 Golden Square, London W1R 3AB. Closing date: Friday 29th January 1988.


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Enlarging the C64

Create User Definable Graphics to produce enlarged characters on your C64.

By Adam Wright

This program will enlarge any character up to a maximum square size of 6(width) by 6(height). In fact, as long as the combinations of width and height when applied to the formula (width-1)*8*(height)+1 is less than 256 then other size combinations can be created. If you can take into account the massive amount of memory that is used when creating enlarged characters then I'm sure that you will appreciate that the size combinations available are very acceptable

The program creates UDG's (User Definable Graphics) which when pieced together in the correct order will produce the enlarged character. This program therefore works in the normal low-res screen mode. One advantage of this method of creating enlarged characters is that no hi-res screen areas have to be assigned. The disadvantage of this method is that the total number of characters redefined must not exceed 255. One way to overcome this limitation is to create the enlarged characters that are going to be used beforehand.

Getting it all in

In order to enter correctly the Enlarge program the following steps have to be taken:

- Enter program 1.
- Run the program making sure there are no errors.
- Save the program (SAVE "PROGRAM 1",1).*
- Save the code by typing SYS 49853 "ENL CODE",49152,49977,1*
- Enter program 2.
- Save the complete program (SAVE "ENLARGE",1*).

*Disk Users replace the 1 with an 8

How to use the routines

Enlarge Character
This is the main routine which as its name suggests, enlarges characters. Routines that must be called before calling this routine are:
Data Store, Character Data, Width, Height
SYNTAX – SYS EC

Print Character
This routine puts the enlarged character on the screen. Note that the kernal print routine could not be used because as you well know, some ASC codes do things like clear the screen, etc, therefore the characters are 'POKED' into screen memory.
Routines that must be called before calling this routine are:
Character Colour, Base Character, XY Position, Width, Height
SYNTAX – SYS PC

Data Store
This routine is used to set up the address for the enlarged characters – (default 12288)
SYNTAX – SYS DS, enlarged character address

Character Data
This routine tells the computer where the 8 bytes of character definitions are – (default 14336)
SYNTAX SYS CD, character definition address

Character Colour
This routine simply changes the current enlarged character colour.
SYNTAX – SYS CC, colour of character

Basic Character
This routine changes the initial character that is used as the base for the Print Character routine. (See example 1)
SYNTAX – SYS BC, base character number

XY Position
This routine changes the enlarged character coordinates.
(Not to be confused with *CURSOR MOVE*)
SYNTAX – SYS, XY, X coordinate, Y coordinate

Width and Height
This routine sets up the width and the height of the character to be enlarged.
SYNTAX – SYS WH, width of character, height of character

Example 1 Base Character

```
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Ø11ØØ11ØØ11ØØ11ØØ11ØØØØØ
Ø11Ø111ØØ11ØØØØØØ11ØØØØØ
Ø11Ø111ØØ11ØØØØØØ1111ØØØ
Ø11ØØØØØØ11ØØØØØØ11ØØØØØ
Ø11ØØØ1ØØ11ØØ11ØØ11ØØØØØ
ØØ1111ØØØØ1111ØØØ11ØØØØØ
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```

Memory Copy
This routine will copy a designated area of memory to another. (Useful for copying character sets).
SYNTAX – SYS MC, start address, destination address, number of bytes to be copied

Memory Fill
This routine will fill an area of memory with a specified byte. (Useful for clearing screens.)
SYNTAX – SYS MF, start address, number of bytes to be filled, byte to fill with.

Cursor Move
This routine will place the cursor at any position. (No more "QQQR").
SYNTAX – SYS CM, Horizontal position, Vertical position

Memory Save
This routine will, as its name suggests, save a portion of memory to the current output device. (Tape users can omit the device number.)
SYNTAX – SYS MS "filename", start address, and address, device number

Memory Load
This routine will load a file from the current input device into the computer at the specified start address.
SYNTAX – SYS ML, "filename", start address, device number, secondry address (if required)

Examples of Enlarged Characters

E.G 1. ASC("A"),WIDTH=3, HEIGHT=

```
ØØØ11ØØØ
ØØ1111ØØ
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Ø11ØØ11Ø
ØØØØØØØØ
```

=

```
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```

24 down, (HEIGHT*8)

8 bits : 8 bits: 8 bits:
(24 bits wide – 3 bytes)

Enlarge Routines Checklist

TITLE	SYNTAX	PARAMETERS	PARAMETER RANGES	ADDRESS
Enlarge Character	SYS EC	None		49154
Print Character	SYS PC	None	-	49508
Data Store	SYS DS,N	N Enlarged Character address	0-65535	49609
Character Data	SYS CD,N	N Character Definition address	0-65535	49625
Character Colour	SYS CC,N	N Colour of Character	0-225 (MOD 16)	49635
Base Character	SYS BC,N	N Base Character number	0-225	49642
XY Position	SYS XX,X,Y	X,Y, Coordinates	0-39,0-24	49649
Width, Height	SYS WH,W,H	W,H, Width and Height	1-255,1-255	49679
Memory Copy	SYS MC,S,D,N	S, Start, D Destination, N Number	0-65535,0-65535,0-65535	49769
Memory Fill	SYS MF,S,N,B	S Start, N Number, B Byte	0-65535,0-65535,0-255	49798
Cursor Move	SYS CM,H,V	H,V Horizontal and Vertical	0-39,0-24	49824
Memory Save	SYS MS", S,E,D	"filename", S Start, E End, D Dev	0-65535,0-65535,1 or 8	49853
Memory Load	SYS ML",S,D,S	"filename", S Start, D Dec, S Sa	0-65535,1 or 8,0-15	49922

screen of the VDC quite easily, but you have to remember BASIC isn't prepared for this, so you may have to write specialist routines to make this possible. First let's try to make the screen smaller horizontally by:

POKE 54784,1:POKE 54785,75

The number of characters displayed has changed to 75, but it doesn't quite work because the spare five columns are printed on the next line. So we must store five to register 27:

POKE 54784,27:POKE 54785,5

This solves the problem by adding five lines to make the total equal 75+5=80. The maximum number of characters is 80. We can also change the number of vertical characters using register 6:

POKE 54784,6:POKE 54785,10

No problems this time. The rest of the screen is swallowed up – even though it is still there if you store 25 in register 6. Now try this:

POKE 54784,6:POKE 54785,26

Wow! We now appear to have 26 lines, although they can't be used yet, and probably contain garbage. In fact we can have up to 32 lines although some monitors may not be able to display them all, so it's best just to add a few. Also, if you change the size of the screen it would be useful if you could centre the display. Well, you can of course. Just use registers 2 and 7 to change the horizontal and vertical syncs respectively. It's best to experiment and I would recommend that your programs that change the size of the screen allow individual users to alter the syncs for their individual monitors.

Like the 40 column screen, the 80 column has an attribute screen, but with some added features. Each of the 2000 bytes (see fig six) affect the corresponding byte of screen RAM, the individual bits mean:

(see Figure 11)

Alt: indicates which character set is in use.
Rvs: Reverses characters, but not used by KERNAL.
Und: Is used to underline characters (CTRL B).
Fla: This bit flashes characters on and off.
Bits 0 – 3 are used for the sixteen colours.

It is also possible to change the position of the screen and the

Figure 5

Copying the VDC RAM from place to place. Store the destination address at 250 and 251, the number of bytes in Acc. Also, store the source address in 252 and 253.

```
.copy   PHA          /temp store number of
        LDX #24      /bytes then set
        JSR read     /copy
        ORA 128      /bit
        JSR write    /and write.
        LDX #18      /store
        LDA 251      /destination
        JSR write    /address
        INX          /high
        LDA 250      /then
        JSR write    /low.
        LDX #32      /store
        LDA 253      /source
        JSR write    /address
        INX          /high
        LDA 252      /then
        JSR write    /low
        PLA          /get number
        LDX #30      /of bytes
        JSR write    /and store
        RTS          /return
```

Figure 6

VDC RAM organisation

$0000	– $07CF	Video RAM, 2000 bytes.
$07D0	– $07FF	Not used.
$0800	– $0FCF	Attribute RAM, 2000 bytes.
$0FD0	– $1FFF	Not used.
$2000	– $3FFF	Character RAM, 8192 bytes, two character sets, 16 bytes per character (8 not used).

Figure 7

Altering underline scan line.

```
10  graphic 5,1
20  for t=0 to 24
30  char, 24,t,chr$ (2)+"How to under line text
    on the VDC"
40  next t
50  do
60  :for t=1 to 8
70  :poke 54784,29:rem "register 29"
80  :poke 54785,t
90  :for d=1 to 25:REM "delay loop"
100 :next d
110 :next t
120 loop
```

attributes, as long as you tell the interpreter, which gets the information from around about $A2F in zero page. You will need to do this if you enlarge the screen. You change these via locations 12 and 13 (screen), 20 and 21 (attributes) of the VDC.

For those proud owners of monochrome monitors you can do away with the attributes altogether and use register 26 for the foreground and background colours. To do this you must clear bit 6 of register 25:

POKE 54784,25:POKE 54785,7

No difference? Well, not yet, but try the program from figure eight. Removing the attributes also allows you to utilise more memory for anything else.

Another feature of the VDC is the ability to change the size of the characters. This could be used as a special effect or just to amaze your friends! The registers controlling the size of the characters are 22 and 23 (bits 0-3). However, at present the system can only display up to a maximum of 8 by 8 pixels. But there are 16 bytes per character in the RAM so does this mean that a larger grid is possible? Try this:

```
1 POKE 54784,9:POKE 54785,15
2 POKE 54784,6:POKE 54785,16
3 POKE 54784,23:POKE 54785,15
4 POKE 54784,4:POKE 54785,19
5 POKE 54784,7:POKE 54785,18
RUN
```

So, it is possible to display an 8 by 16 grid, but what about 16 by 8. I'm afraid I haven't figured out how to do this, and I don't think it's possible.

Remember smooth scrolling on the VIC, well it's also possible on the VDC, using registers 24 and 25 for vertical and horizontal scrolling respectively. Notice that 16 bits can be scrolled in the horizontal plane. If bit 4 of register 24 is set then only 22 lines (as opposed to 25) are displayed so you can scroll the next three on. Also, you don't lose lines when scrolling on the VDC, try the program in figure nine.

The cursor is, as mentioned before, controlled by the VDC and has several registers controlling it, namely 14, 15, 10 and 11. Registers 14 and 15 define the address the cursor is at. Register 10 bits 5 and 6 indicate the cursor mode:

00 – The cursor is still.
01 – The cursor is off.
10 – Fast blinking.
11 – Slow blinking.

Bits 0-4 indicate the top line of the cursor, because you can define it as underline, overline, solid, or anything you like. Register 11 defines the end

Figure 8

Changing the character size.

```
10  graphic 5,1
20  input "What is your name';nm$
30  nm$=" : "
40  n%=2000/len (nm$)
50  scnclr
60  poke 54784,22:poke 54785,112
70  poke 54784,23:poke 54785,0
80  for t=1 to n%
90  print nm$;
100 next
110 for n=1 to 10
120 for x=0 to 8
140 poke 54784,22:poke 54785,112+x
150 poke 54784,23:poke 54785,x
160 for d=1 to 30
170 next d,x,n
180 sleep 5
190 end
```

Figure 9

The VDC scrolling registers.

```
10  graphic 5,1
20  fast
30  for t=0 to 24
40  char,27,t,"Hello all you C128 owners!"
50  next
60  do
70  :for t=0 to 7
80  :poke 54784,24
90  :poke 54785,32+t
100 :for d=1 to 60
110 :next d,t
120 loop
```

Figure 10

The cursor mode.

```
10  fast
20  poke 54784,11:poke 54785,5
30  for m=9 to 96 step 32:rem "bits 5 and 6"
40  poke 54784,11:poke 54785,2+m
50  for x=0 to 79
60  poke 54784,14:poke 54785,0
70  poke 54784,15:poke 54785,x
80  for=1 to 20:rem "change delay to suit
    yourself"
90  next d,x,m
100 end
```

scan line. Both are from 0 to 15. See figure 10 for an example of the cursor modes.

And now we come to the highlight of this article. Want to know a secret? HIGH RESOLUTION GRAPHICS! Yes, bit 7 of register 25 defines text or graphics mode and normally the hi-res mode is 640 by 200. This is comparable to the BBC mode 0 graphics, and is quite impressive. However, you will have to write your own graphics routines as Commodore forgot, although I saw a package at a Commodore show which could handle hi-res graphics in 80 column mode. Try this:

```
POKE 54784,25:POKE 54785,135
```

However, if you want to use 16384 bytes instead of 16000 then try this:

```
1 POKE 54784,1:POKE 54785,64
2 POKE 54784,2:POKE 54785,96
3 POKE 54784,6:POKE 54785,32
4 POKE 54784,7:POKE 54785,36
5 POKE 54784,25:POKE 54785,135
```

This gives graphics of resolution 512 by 256. I use this a lot more because you can use a technique used on the BBC. Remember registers 12 and 13? Append this to the above program:

```
6 DO
7 FOR T=0 TO 63 STEP 2
8 POKE 54784,13:POKE 54785,T
9 FOR S=0 TO 49:NEXT S,T
10 LOOP
```

What this program does is move the start of the screen, and as the screen takes exactly 16K bytes then it will wrap around in memory. This is a great feature and scrolling becomes easy. The procedure would be to change the start of the screen instead of scrolling memory, which makes scrolling easy and quick. Also, if Commodore had thought to give the VDC some more memory (quite possible), say 32K bytes then it would have been possible to have displayed 640 by 400 or 512 by 512 pixels resolution using the interlaced graphics mode on register 8. Try poking 255 to this register!

Well, that's all I have to say about the VDC, and I assure you that there is a lot left to find out, and special effects to find. One final possibility that I thought about was to use the 16K bytes as storage for music data, etc. Also, you can use the VDC in 64 mode (as well as the 2 MHz mode). For other information on the VDC refer to one of the good C128 reference guides or The Anatomy of the Commodore C128. YC

Figure 11

A complete list of the VDC registers.

0 :	(126)	:total number of characters/line including beam return.
1 :	(80)	:Number of characters displayed across screen.
2 :	(102)	:Left border sync. Increasing this register moves the screen left.
3 :	(73)	:Sunc width. Bits 0-3 determine hor. sync pulse width in characters, bits 4-7 determine vert. sync pulse width.
4 :	(39)	:Total number of lines including beam return.
5 :	(224)	:Fine adjustment for register 4.
6 :	(25)	:The number of vertical lines displayed.
7 :	(32)	:Upper border sync. Increasing this moves the screen up and decreasing it moves the screen down.
8 :	(252)	:This register determines the interlace mode.
9 :	(231)	:Bits 0-4 determine the number of raster lines/ character minus one. The default is 7 (bits not used appear as 1) meaning 8.
10 :	(160)	:Bits 5-6 set cursor mode and bits 0-3 set cursor start raster.
11 :	(231)	:The line at which the cursor ends is held in bits 0-4 (normally 7).
12 :	(0)	:The high byte of the address of the screen.
13 :	(0)	:The low byte of the address of the screen.
14 :	(???)	:The high byte of the cursor position.
15 :	(???)	:The low byte of the cursor position.
16 :	(???)	:The vertical address of the light pen.
17 :	(???)	:The horizontal address of the light pen.
18 :	(???)	:The high byte of the address to be copied, written to or read from.
19 :	(???)	:The corresponding low address of REG 18.
20 :	(8)	:The high byte of the attribute screen.
21 :	(0)	:The low byte of the attribute screen.
22 :	(120)	:Bits 4-7 determine the number of displayed horizontal lines (7). Bits 0-3 determine the number of vertical displayed lines (8).
23 :	(232)	:Number of vertical lines displayed (height)
24 :	(32)	:Bit 7 tells VDC whether copying, reading or writing. Bit 6 is the REVS bit, used by <ESC> R and <ESC>N. Bit 4 swallows up the last three lines of text on vertically. Bits 0-3 are used for vertical scrolling.
25 :	(71)	:Bit 7 indicates high or low res. mode. Bit 6 indicates the use of attributes. Bit 5 determines semi-graphic operating mode. Bit 4 indicates double width characters. Bits 0-3 are for horizontal scrolling.
26 :	(240)	:When in monochrome mode (bit 6 of REG 25), bits 0-3 determine background colour, and bits 4-7 indicate foreground colour.
27 :	(0)	:The number of characters added to the end of each line. If you make the screen smaller you must make sure REG 1+REG 27=80.
28 :	(47)	:Character base address (bits 5-7) in 8K steps.
29 :	(231)	:Indicates which line to underline, and can be from 0-15.
30 :	(???)	:Number of bytes to be copied or stored.
31 :	(???)	:Holds data for reading or writing to RAM.
32 :	(???)	High byte of start address of block to copy
33 :	(???)	Low byte of start address of block to copy
34 :	(125)	:Number of characters from start of line to first character to be displayed. Can be used to cover left edge of screen.
35 :	(64)	As REG 34 but for right edge of screen.
36 :	(245)	:Bits 0-3 indicate the DRAM refresh rate.

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Array Display Subroutines

Create a screen input and display routine which acts on string arrays, with this handy program. ***By Paul Williams***

When writing business packages or other programs for serious applications, it is often necessary to have screen layouts containing a lot of data all at the same time (for example one record in a database program or the description of one item in a stock control package).

The best way of entering and modifying the data is for the user to be able to move a cursor around the various fields on the screen, using the screen editor to amend the data. However, the cursor must not be allowed to stray outside each field, otherwise it would be very easy for the user to corrupt the screen, and if the user were not familiar with computers, become very confused.

The program described here is a screen input and display routine which acts on string arrays, providing the following advantages over the normal Basic INPUT command, while still being easy to use.

1. The programmer defines the field positions and sizes on the screen, and it is impossible for the user to stray out of these fields when editing.
2. When editing, the current field is highlighted to show the user the maximum size of entry expected by the program.
3. Left and right cursor controls, home, clear and insert and delete can all be used when editing, but only effect the current field, even if other fields are present on the same screen line.
4. Up and down cursor movements automatically move the user to the previous and next fields on the screen.
5. Apart from the allowed control characters, only letters, digits and characters such as ! and % etc are accepted.
6. Quotes, commas and colons are all readily accepted as legitimate input characters, and do not cause ?EXTRA IGNORED errors.
7. The programmer can specify that editing is restricted to one particular field, or all the fields on the screen.
8. All the fields on the screen can be displayed or cleared with one command. Also, editing the whole screen is performed with just one command.
9. The whole system produces very neat screen displays, allowing editing to a professional software standard.

The program relies on three one-dimensional arrays for its operation; a field position integer array P%, a field length integer array L%, and a data array S$ containing the information to be displayed and modified. The array names are arbitrary – you can use any letters but the two numeric arrays must be integer.

Array P% contains the displacement of each field from the top left home position on the screen, e.g. the first column on the second screen line is a displacement of 40 from the top, and the middle of the bottom line is 980. Thus, P%(1) defines the location of field 1, and P%(2) defines that of field 2.

Array L% defines the maximum length of each field – this number determines the size of the highlighted area on the screen and the number of characters strings are truncated to when being displayed by the routine. L%(1) contains the length of the first field, and so on.

It is also necessary to set L%(0) to the number of fields present on the screen.

**Array S$** simply contains the ASCII strings of data to be displayed; the routine directly modifies the elements of S$ when editing is taking place.

Once the arrays have been defined, the subroutine is executed in this way:

SYS49152,P%(0),L%(0),S$(0)

(or whichever array names you have chosen) displays the elements of S$ in their respective fields.

SYS49155,P%(0),L%(0),S$(0)

allows the user to edit the data in the fields on the screen. The user can move between fields with the cursor up and down controls, and when RETURN is pressed the data in the fields is put back into the elements of array S$. Editing and movement can be restricted to, say field N by P%(0)=N before the above SYS command. If P%(0)=0, editing is allowed in all the fields.

SYS49158,P%(0),L%(0),SS(0)

clears all field areas on the screen.

The main advantage of this system over normal INPUTs is that if the user has a lot of data to enter on the screen, it is possible to get to the end of the screen, then decide the top record needs modifying, and the cursor controls can be used to skip across the fields to reach that field. The Basic program is held up until the user is completely satisfied with the whole screen; then he/she presses RETURN and all the data is returned to the Basic program in one go.

The machine code program occupies locations $C000 to $C326 (hex), and a Basic loader is listed. This contains checksums which will point out typing errors when this program is run. Once the program has been installed using this loader, your Basic program can make full use of the package. To demonstrate how the routine is used, a Basic program has been included which draws up a typical stock-control screen and allows full-screen editing restricted to the defined fields. The program is fully commented and should need no further explanation.

The routine is ideal for taking the struggle out of writing business-type packages – after all databases and such like can quite easily be written effectively in Basic, as long as a foolproof and easy to use input routine is available – this program provides just that! YC

See listings on page 77.

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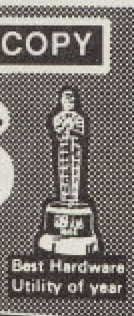
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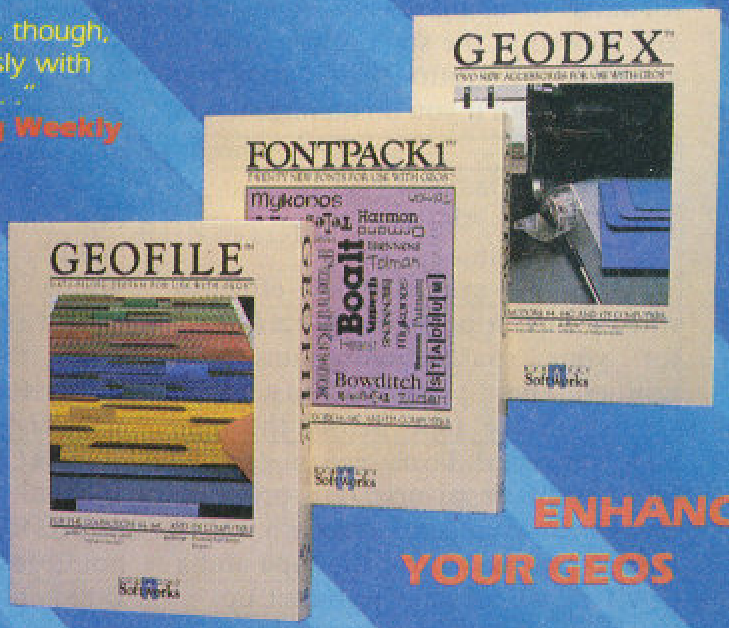
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C64 Tape System

Provide a menu driven access to multi-program library tapes with this handy program.

By Richard Kyme-Wright

Have you ever put more than one utility or backup program onto a single tape? Have you then forgotten to note the tape counter setting at the start of the second program and had to fish around on tape looking for it?

Unless you are one of the chosen few, or you rigidly use one tape per program, this utility is for you.

The program offers a selection menu of the titles of programs stored on the tape. When a selection has been made, the tape will be spooled to the start of the selected program and the LOAD sequence commenced.

The difference between this tape-accessing system and any other I have encountered is that there is no need to REWIND the tape to the beginning for a fresh look at the menu. This menu occurs between the programs so that it is ready to use at any time.

Tape Layout

When you have loaded a program the tape stops at the end of that program and before the start of the next. This is the perfect spot to find a menu. From this menu, any other point on the tape can be reached by spooling fast forwards or using rewind. A menu is also placed at the start of the tape to act as a 'registration' point that you can easily find if you do manage to get lost.

Limitations

The C64 tape system is only effective when a tape is being used as a library for your routine, programs and utilities. These programs must all be set up on the tape before the tape system is added. To change the content of the tape or to update a program involving a change in its length would corrupt the layout on the tape and a new tape would have to be set up.

The system can accommodate as many programs as the tape can hold. During the setting up, however, the more programs you have assembled onto a tape the greater the number of spool-time intervals to be measured will be, and the necessary increase in data statements will make the menu program longer in size and take longer to load.

The spooler has been compacted to occupy a minimum number of bytes (2444 bytes for the six title version.) This takes 65 seconds to load normally but can be cut to as little as ten seconds when using a turbo-save program or utility cartridge. (Ten seconds to "load" when I use Final Cartridge II.)

The spooler will close off by instigating the normal loading commands of the C64 when the tape has been spooled to the correct position. The method of calling the next program can be tailored to meet individual program requirements. See Figure 1 for details of this.

Setting up the tape

Type in and "save" the two programs listed here. Note that these are two separate programs and not two parts of the same one.

Place a good quality audio cassette in your 2N cassette unit and reset the counter to 000. Use fast forward to advance the tape past the leader strip; give yourself some spare tape at the start so stop it at a counter reading of, say, "030". There should be enough tape spooled to save the "timer" or "spooler" programs at the start of the tape and not run past this point. At "030" save the first program in your library. Note the counter value at the end of the "save" then use "play" to move the tape forward for "70" seconds to leave a space to save the spooler later.

Use an appropriate shorter time interval if you are utilising a fast-save utility. The tape is now at the start point for the next library program. Build up your tape in this manner until you have the required number of programs on the tape, and leave enough room at the end of the tape for a final spooler program.

Now I recommend that you rewind the tape, reset the counter and load each program in turn. Check that the programs load alright and that the counter values agree with your notes. Note that the true start point for each program will be 70 seconds (or less) beyond the end of the previous program and not at the point where your C64 announces to you that it has found something.

You now have all the information you need to measure the time it takes the cassette drive to spool between any two of the start settings.

Running the timer program

The TIMER program has to be saved at the very start of the tape. Instructions on its operation are displayed as you go along. Proceed as directed and make the necessary notes on the spooling times chart. Remember, read the tape counter while the tape is being spooled, press space bar as it approaches the required value as the tape will overrun slightly when switched off. This will take a little practice to get right.

Use the chart layout as suggested in Figure 2 to avoid getting lost between the different programs on the tape. Record the timer values obtained from a rewind as negative values and those from fast forward as positive values. Note that the last line of the chart is set with all negative values. This records the rewinding time to reach the start point of each program from the forward end of the tape. This point is 70 seconds of 'play' time (or less) beyond the end of the last program. Make a record and refer to Figures 2 and 2.1 for more details.

Setting up the spooler program on the tape

When your chart is complete LOAD the spooler program (do not RUN it as it will reset itself with NEW when it finishes). List out line 16 and replace

the text found within the quotation marks with the general title for this tape. (Overtype the text then press RETURN). Do not use the INSERT or DELETE key as the layout of the screen would be corrupted.

Overtype the text in the data statements beginning at line 74 with your program titles in their order on the tape. This is the point where you can tailor the spooler program to the actual contents of your tape.

If the number of titles is six or less use lines 74 to 80 as given in the listing. Type in all six titles or, if less than six, put in spaces of text on the unused data lines. Select the appropriate method of loading each program from the chart in Figure 1, and put the relevant code into each title line after the coma. Take the first line of numbers from your chart of spool times and type them over the "+0000"s in line 80.

Your data lines should look like this for four titles:

```
74 DATA" 1: PROGRAM TITLE ONE ",1
75 DATA" 2: TITLE OF PROGRAM TWO ",2
76 DATE" 3: HERE IS PROGRAM THREE ",2
77 DATE" 4: PROGRAM FOUR ",1
78 DATA"                   ",0
79 DATA"                   ",0
80 DATA+0000,+0540,+0732,+1355,+0000,+0000
```

or this for six titles:

```
74 DATA" 1 PROGRAM TITLE ONE            ",1
75 DATA" 2 TITLE OF PROGRAM TWO         ",2
76 DATA" 3: HERE IS PROGRAM THREE       ",2
77 DATA" 4: PROGRAM FOUR",1
78 DATA" 5: THE FIFTH PROGRAM           ",3
79 DATA" 6: PROGRAM NUMBER SIX          ",1
80 DATA +0000,+0540,+0732,+1355,+1760,+2321
```

If more than six titles are required use line 79 (item six) for the NEXT SELECTION option and set the code at the end of the line to '8'. (This triggers the program to the next page of titles.)

Retype the data lines as in lines 74 to 80 starting with the new line number of 81.

Item six must again be the NEXT SELECTION option and if this is the last page, set the code at the end of the line to '9'. This makes the display revert to the initial selection.

```
74 DATA" 1: SOUND CREATOR          ",2
75 DATA" 2: SOUND MAKER            ",3
76 DATA" 3: SOUND SEQUENCER        ",2
77 DATA" 4: MUSIC THEMES ALBUM     ",1
78 DATA" 5: MUSIC HITS.ALBUM       ",1
79 DATA" 6: ————————▼ NEXT LIST ▼",8
80 DATA-7650,+0000,+0100,+1630,+2410,+0000
81 DATA" 1: MELODY TIME, POP HITS  ",1
82 DATA" 2: SYNC. SYNTH. CLASSICS  ",1
83 DATA" 3: TUNES FOR YESTERDAY    ",2
84 DATA" 4: TUNES FOR TOMMOROW     ",2
85 DATA" 5: TUNES FOR TODAY        ",2
86 DATA" 6: ————————▼ NEXT LIST ▼",9
87 DATA+3170,+3920,+4670,+5210,+5880,+0000
```

In the second example I have gone a stage further and used eleven titles spread over three pages!

```
74 DATA" 1: SOUND CREATOR             ",2
75 DATA" 2: SOUND MAKER               ",3
76 DATA" 3: SOUND SEQUENCER           ",2
77 DATA"NOTE ABOUT HARDWARE PUT HERE!!",0
78 DATA"==============================",0
79 DATA" 6: ————————▼ NEXT LIST ▼",8
80 DATA +0100,-0765,+0000,+0000,+0000,+0000
81 DATA" 1: MUSIC THEMES, ALBUM       ",1
82 DATA" 2: MUSIC HITS, ALBUM         ",1
83 DATA" 3: MELODY TIME, POP HITS     ",1
84 DATA" 4: SYNC. SYNTH. CLASSICS     ",1
85 DATA"==============================",0
86 DATA" 6: ————————▼ NEXT LIST ▼",9
87 DATA+1630,+2410,+3170,+3920,+0000,+0000
88 DATA" 1: TUNES FOR YESTERDAY       ",2
89 DATA" 2: TUNES FOR TODAY           ",2
90 DATA" 3: TUNES FOR TOMMOROW        ",2
91 DATA" 4: TUNES THAT NEVER WERE ... ",2
92 DATA"==============================",0
93 DATA" 6: ————————▼ NEXT LIST ▼",9
94 DATA+4670,+5210,+3170,-1870,+0000,+0000
```

Figure 2: chart layout for recording Timer values

Figure 1: the options available to the spooler when it hands over to the LOAD sequence.

CODE	LINE	Produces the following response	
1	60	Hold down Shiftkey and press RUN/STOP 'READY'	(use to create an AUTORUN command when loading BASIC)
2	61	LOAD"",1,1 < return > 'PRESS PLAY ON TAPE'	(normal LOAD command)
3	62	LOAD"",7 < return > 'PRESS PLAY ON TAPE'	(for use with programs saved using the 'freeze' or 'turbo' facilities of Final Cartridge II)
4	63		
5	64		
6	65		
7	66		

Space is available in lines 63 to 66 to define any other load variations you require.

Of course, if your list of titles continues, lines 81 to 87 will be full and the block of lines 74 to 80 can then be repeated again on new lines 88 to 94.

Here are two examples adapted from one of my own applications. In the first there are ten titles on the menu and option six on each 'page' is used to turn to the list on the next 'page' (or to go back to the first 'page').

In this second example I have gone a stage further and used eleven titles spread over three 'pages'.

It is important to note the timer values are not in sequence in lines 80, 87 and 94 as the titles have been grouped by subject and not by the position on the tape. Each timer value must correspond to the program title in the list that owns it. (Type in these data lines and run the program to see how it handles them. Change the NEW command in line 73 to a STOP command first or your experiment will involve a lot of re-LOADS.)

With the data lines set up, save the spooler program using the fast-save facility (if you have one) at the appropriate position before the start point of the first program. Next spool forwards to the end of that program, using the tape counter and your notes for guidance.

List spooler to your screen then overtype the timer values (lines 80, 87 etc.) with the second set of figures from your timing chart then SAVE spooler at the tape position you have now reached.

Continue this process until spooler has been saved between each program on the tape and once more after the last program using timer values that are all -ve.

Begin with the tape positioned at the start of one of the programs by setting the tape to the tape counter value noted for that program on the left of this chart; spool to the start point of a program listed along the top, and record the timer value displayed by the spool timer program in the appropriate box on the chart. See Figure 2.1 for an example.

This chart can be expanded to accommodate any number of programs as long as there is one column per program and one line more than the number of columns.

Figure 2

PROGRAM NUMBERS	1	2	3	4	5	6		
1	+0000	+	+	+	+	+		
2	-	+0000	+	+	+	+		
3	-	-	+0000	+	+	+		
4	-	-	-	+0000	+	+		
5	-	-	-	-	+0000	+		
6	-	-	-	-	-	+0000		
7	-	-	-	-	-	-		

TIMER VALUES

Figure 2-1

PROGRAM NUMBERS		1 030	2 055	3 075	4 100	5 120	6 135	7 150	8 170
1	030	+0000	+0350	+0664	+1040	+	+	+	+
2	055	-0190	+0000	+0290	+	+	+	+	+
3	075								
3	075	-0350	-0150	+0000	+0360	+0660	+	+	+
4	100	-	-????	-0220	+0000	+0275	+0510	+	+
5	120	-	-	-0400	-0170	+0000	+220	+0450	+
6	135	-	-	-	-0345	-0318	+0000	+0270	+0520
7	150	-	-	-	-	-0310	-0160	+0000	+0280
8	170	-	-	-	-	-	-0390	-0215	+0000
9	200	-	-	-	-	-	-	-	-0350

Timer – Process Description

Line	Description of process
100	Set up background and border colours
110-210	Paint screen layout
220	Deposit character on last position of screen
230-300	Display instructions on the screen, reset the keyb'd register
310	Read keyboard character
320	If character=f1..... (EXIT)
330	If cassette 'STOP' key has been used....
340	If character < > space bar....
350-430	Paint timer box on screen
440	Set up timer reference, start spooling the tape
450	Calculate elapsed time
460-570	Display elapsed time, LOOP until space bar is pressed
580	Stop spooling the tape
590	Display prompt "PRESS RETURN TO RESET 'TIMER'"
600-630	Read keyboard character, respond to "RETURN KEY" and "f1"
640-650	Display prompt "READY FOR NEXT" and reset timer display
660-690	Read keyboard character, respond to "f1", "STOP", "SPACE BAR"
700	Reset timer value and go to line 450 (LOOP)
710	BUZZ and FLICKER error procedure
720-750	Display the error message
760	Exit from the program – END

Figure 2.1: This is an example of the chart when partly filled in. The top and left side of the form is used for noting down tape counter values for the start point of each program present.

E.g. (In this example)

The next spool time to be measured is the one between the start of program four back to the start of program two.

The tape counter should show the number "100". Press the rewind key and then the space bar. Press the space bar again when the counter runs back past "57" to allow the tape to come to rest at "55". Note down the timer value in the box marked "????". (I get a timer value of "0390" for this one.)

The Best of 1987

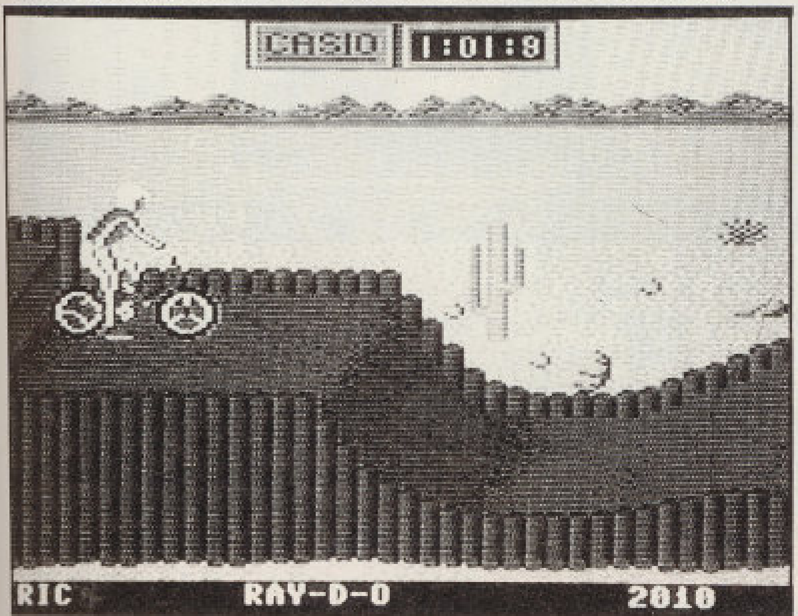
Whether you are looking for a present to buy or want to treat yourself, you'll find something in our list of favourites from 1987.

By Tony Hetherington

It's been a great year for games with more American giants setting up shop on these shores. Soon you won't have to wait for the latest game from Electronic Arts, Microprose, Origins or Infocom as they'll be released simultaneously here and in the States.

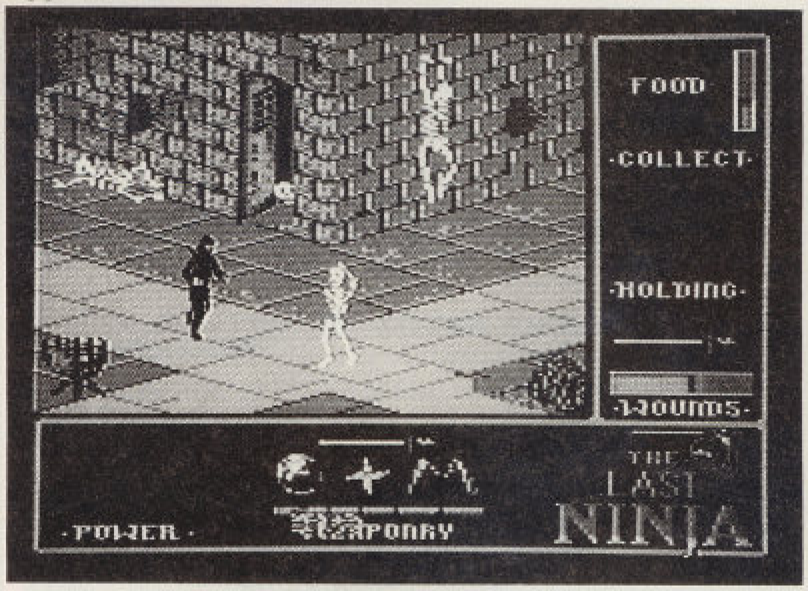
This top ten has been compiled by the marks given by the reviewers of each game of the month. For a full review check the relevant copy or contact our back issues department.

California Games/EPYX/US Gold/£9.99 cass/£12.95 disk.
The fifth and finest of the *games* games that started in Summer, passed through Winter and then went around the World. Now California games takes you through six sun soaked sports that feature skateboarding, foot bagging, surfing, roller skating, BMX racing and finally frisbee flinging.



Sentinel/Firebird/£9.95.
A battle of skill and strategy pits you against the energy absorbing Sentinel across a staggering 10,000 landscapes. Your aim is to get to the highest peak and absorb the Sentinel before it gets you.

The Last Ninja/System 3/£9.29.
In what must be the last word in marshal arts games you have to punch, kick and kill an increasing variety of opponents with a growing arsenal of weapons that are strewn about the glorious graphic landscapes. If you're into combat games that get the Last Ninja; it beats the opposition.



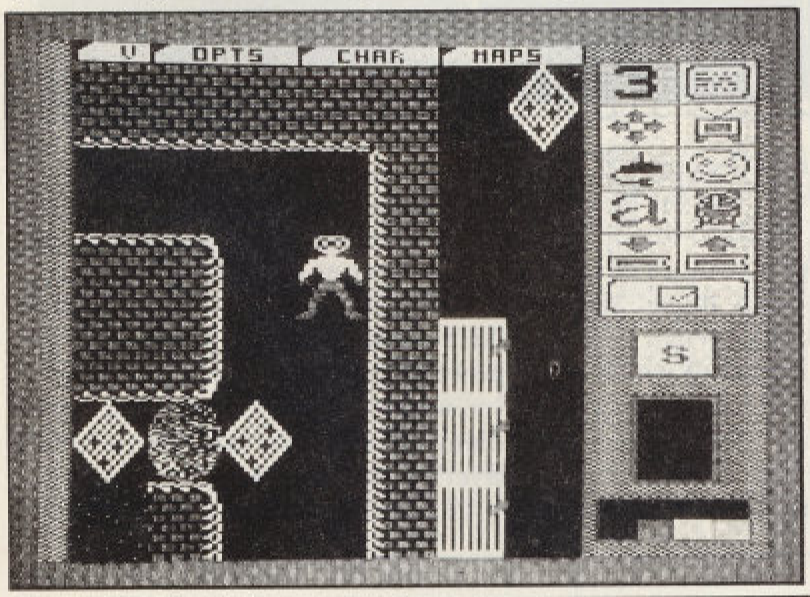
Druid/Firebird/£7.95.
Druid was the best of the Gauntlet clones as it added the use of spells to top down scrolling adventuring. Our hero has to battle with ghosts, beetles and demons to reach chests that contain magic spells and pentagrams that replaced lost energy. When you opened a chest you were faced with a dilemma of which of the powerful spells you should choose. Should you collect more fire, water or electrical attack spells, grab a key or even the Golem, a faithful servant, that could be played by a second player? If you haven't got a copy of Druid yet, then there's no dilemma, buy one.

Gunship/Microprose/£14.95 cass/19.95 disk.
Gunship took flight simulators to new heights with a combination of an easy to fly helicopter that bristled with weaponry and an addictive gameplay that included flying over 100 missions throughout the warzones of the world. If you succeeded in wiping out enemy command posts, tanks, helicopters, gun emplacements and infantry you could gain promotions and medals and progress to more daring missions.

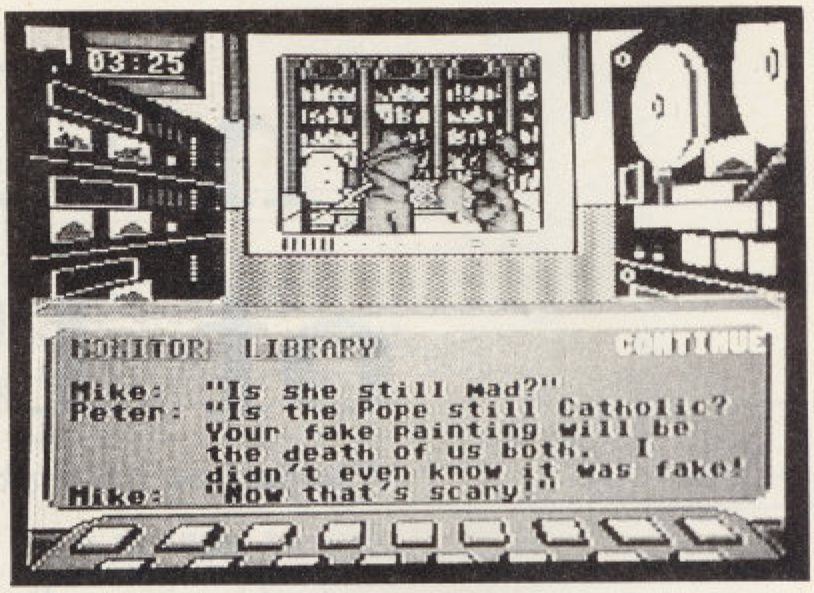
Stifflip and Co./Palace/£9.99 cass/£12.99 disk.
Stifflip and Co. brought good eggs, cucumber sandwiches and stiff upper lips to the wicket of adventures as four all round heros set off to a South American banana republic to stop some bounder destroying the world. You'll have to keep a straight bat and wits sharpened if you're to survive the onslaught from Generals and other jungle types. Some of these can be solved with fisticuffs, others will need the old thinking cap.



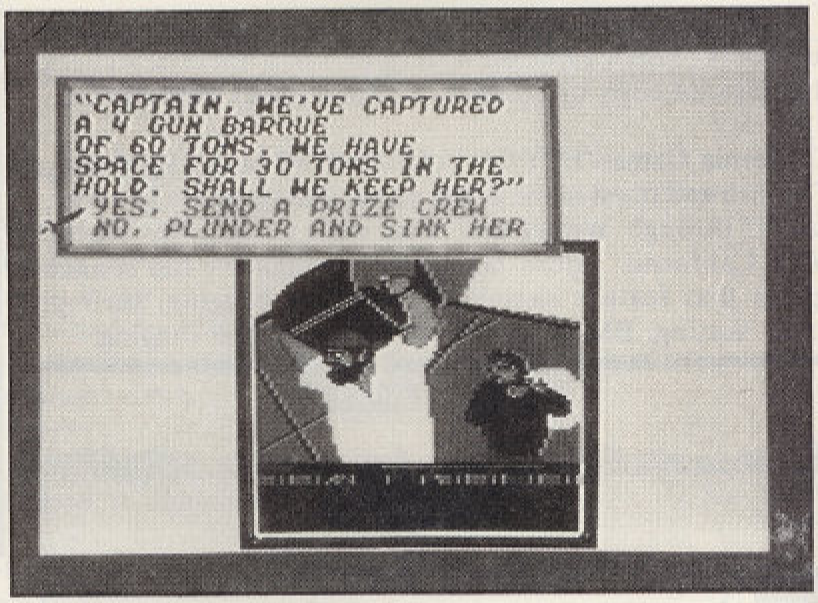
Repton 3/Superior/£9.95.
A boulderdash style of game in which you must collect diamonds and a golden crown to progress to the next level while avoiding plummeting rocks, hatching monsters and ghastly ghosts. A great game if you can keep your nerve. If you can't, you'll soon be given a crushing blow.



Killed Until Dead/Accolade/US Gold/£9.99.
Murder, mystery and mayhem lie in store as the Midnight murder club has just booked into the hotel where you're the house detective, and they're all out to prove that they're the world's greatest murderer. Luckily, you're the world's greatest detective and with the help of security cameras and less subtle breaking in rooms, you just might solve the 20 cases supplied on the game tape or disk.



Pirates/Microprose/£14.95.
The first ever swashbuckling simulation takes you to the high seas as you take command (fight for command) of a pirate ship. From there you sail the seven seas in search of treasures to plunder and forts to attack. You can opt to be an all out pirate and steal from any ship or instead become a privateer and serve King and country which means you plunder ships from the rest of the world. A superb simulation that's easy to get into despite the daunting task of a 90 page instruction manual!



Gauntlet/US Gold/£9.99.
The pick of the coin-op conversions that gives you 512 dungeon levels to explore as you battle with ghosts, grunts, lobbers and sorcerers. This excellent game is now just part of US Gold's Solid Gold compilation which is this month's game of the month.

FOUR FEATURED ADD-ONS.

Are you happy with your computer system or do you want to stretch it a little further? If so, here are four add-ons that *Your Commodore* has featured in the last year.

Accelerator +/Evesham Micros/£159.95.
Evesham Micros produced an alternative to the large and lumbering Commodore 1541 disk drive. The Accelerator + is smaller and slimmer, compatible with nearly all disk software, claims to be up to 25% faster and costs £40 less!
Teletext Adaptor/Microtext/£69.95.
Teletext is the information service that's broadcast alongside BBC and ITV programs. Until now you had to buy a

specially adaptored TV to receive this information but thanks to the Microtext teletext adaptor you can use your C64. You can not only read the pages of news, results, reports and TV listings but also use the information in your own programs thanks to a screen reading utility.

LOAD-IT/Load-It/£19.95.
Available either ready fitted or as a kit for £10 less this little device could save you hours of anguish as you watch tapes not loading. By simply turning a graduated switch you can adjust the angle of the read head in your datasette and load in nearly all those programs that you thought were unloadable.

Eprommer 64/Datel/Electronics/£39.99.
Together with Datel's Cartridge Development system (£12.99) you can now create your own cartridges by down loading your programs onto an Eprom and then building it into a cartridge. Push your new cartridge into the C64, turn on and there's your program ready to use. With full, easy to follow instructions you can't afford to ignore Eprom programming.

BUSINESS AND UTILITIES

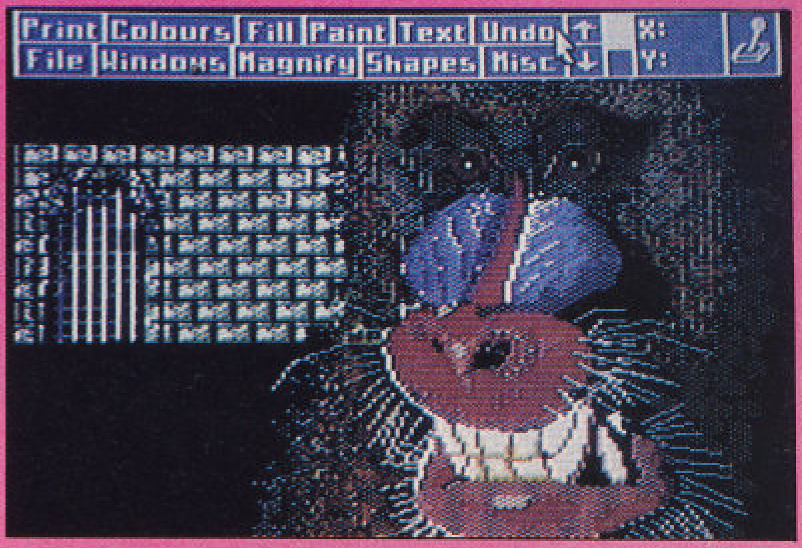
More and more people are using their computers for more "serious" applications either for word processing, storing information or devising amazing graphics. Here are ten programs that we have featured in the *Your Commodore* that will put your C64 to work.

Mini Office II/Database/£14.95 cass £19.95 disk.
Mini Office II is a package that represents excellent value for money as it includes a word processor, database, spreadsheet, graphing utility, comms pack and label printer all for the price of one. The menu controlled package is easy to use, fully compatible and a must for all users.

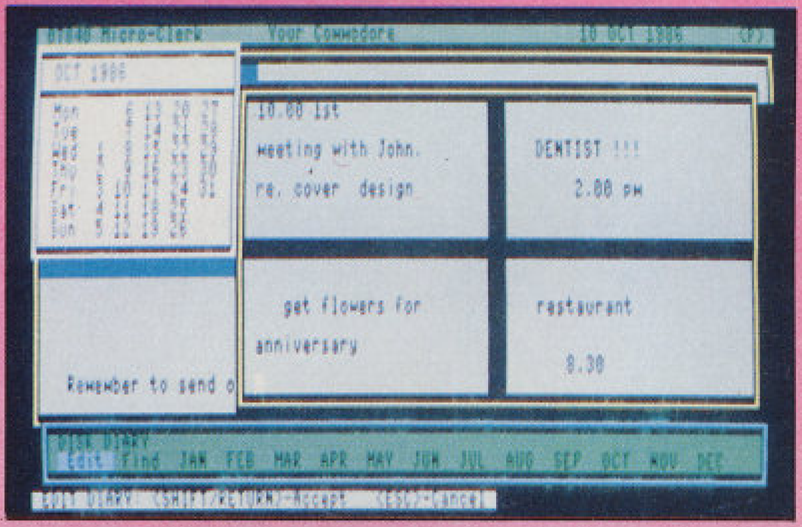


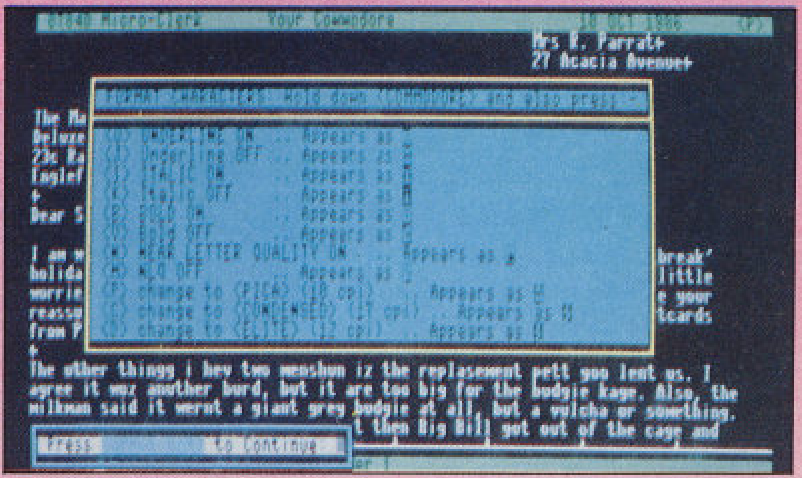
Stop Press/AMX Software/£39.95.
Available on its own or with the AMX mouse for £69.95, Stop Press is a flexible desktop publishing program that can take text from any PET ASCII file and then print it in a variety of fonts and combine it with a library of clip art. The results can then be printed out to form a newsletter or saved for later use.

Advanced Art Studio/Rainbird/£24.95 (disk).
The Advanced Art Studio is the first of two graphics packages featured in this roundup. Based on the original window and pull down menus of the Art Studio, it includes added features such as support for multi colour mode, user defined brushes that can include four colours and can be 12x16pixels big and load, and save and sized window of the screen as easy to build up picture elements.

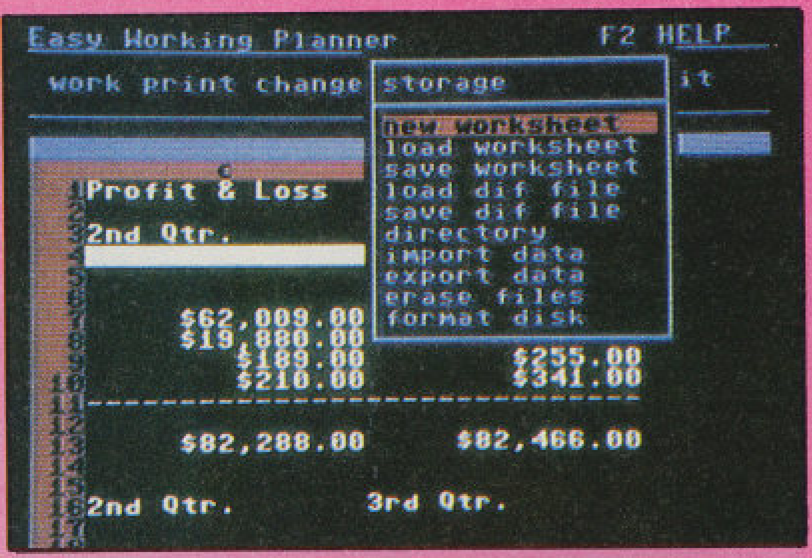


Micro Clerk/JCL/£99.99.
A combined business package for the C128 puts this machine to work and turns it into an essential workhorse for all small businesses. The package not only contains a word processor, spreadsheet, cash book and database but also can be expanded through extension packages that include a sales ledger, purchase ledger and payroll.

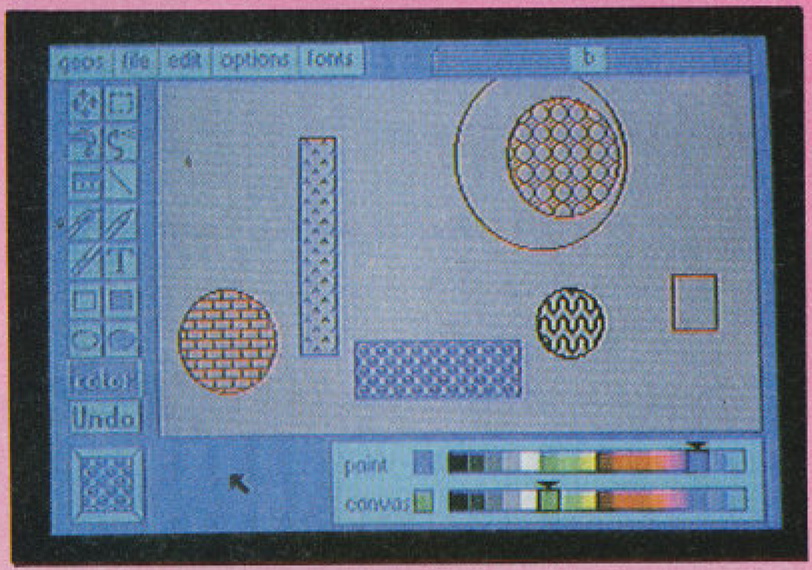


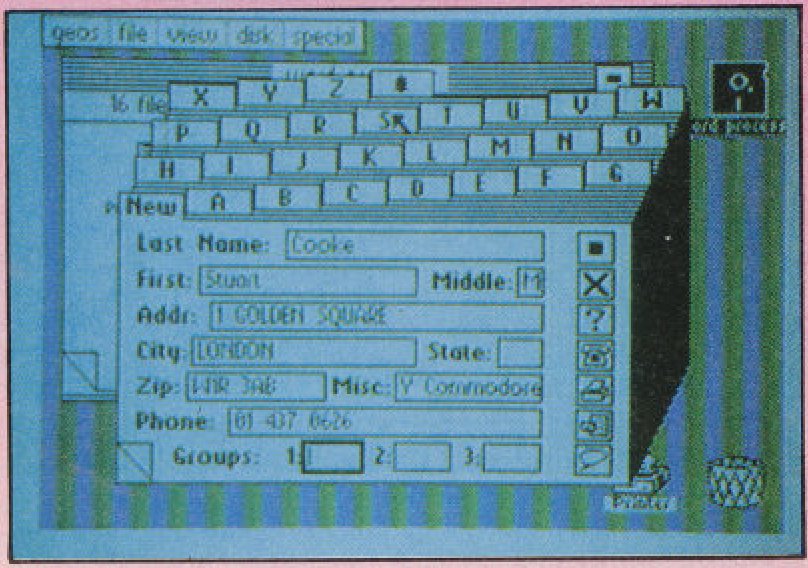


Logotron 1295/Logotron/£12.95 each.
A trio of packages that have been tailor made for the British market from the American Spinaker originals. Planner 1295 is a particularly comprehensive spreadsheet program and is matched by Writer 1295, and Filer 1295, both for ease of use and value for money. Could this trio become the Lotus 1-2-3 of the C64 world?



Geos Extensions/Berkley Softworks/Microprose UK/£29.95.
GEOS, the Graphic Environment Operating System, disk operating system first brought windows and icons to the C64 earlier this year. Now through a new importer the cost has come down and the original system has now been joined by Writers Workshop, Geofile, GeoCalc and more fonts and desktop utilities including a graphics grabber that can take Newsroom and Print Shop graphics.

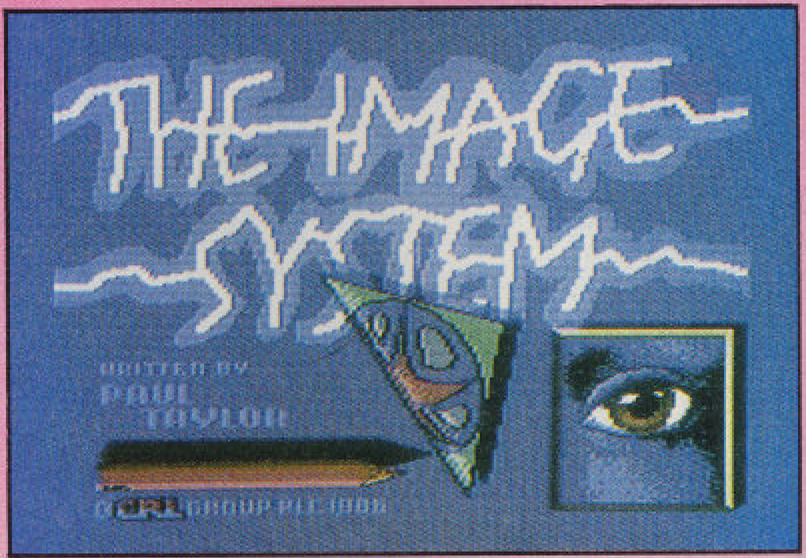




Video Title Shop/US Gold/£14.99.
A graphics package and a screen animator combine to form a package that can be used for anything from a title page for the video of Fred's birthday to a full advertising demo. The text and graphics are created on screen where they can be animated in a variety of ways and stored either on disk or recorded onto a video.



The Image System/CRL/£24.95.
Described as one of the best graphic programs available for the C64 the image system uses the now standard method of joystick control and has a variety of menus from which you can draw, fill and colour shapes, as well as the unusual image menu that not only allows you to save, magnify and print parts of the screen but also distort and twist the shape into any other.



Blinker-64/Information Development Systems/£29.90.
Blinker-64 is an invaluable utility for Basic programmers and allows you to write programs using existing subroutines that you have already written, tested and debugged on disk. When you've completed the program, Blinker-64 pulls in the routines and renumbers the program and presents a full on screen report including the start and end addresses and the number of modules used.

The Toy Shop/Precision Software/£39.08.
20 working toy models that can be printed out and then built are included on one disk, along with full instruction manual and sundry extra componets such as small pieces of dowel, rubber stripping and balloons. This may sound a bit like Blue Peter and a bit pointless but it is actually great fun. This could send the paper aeroplane industry to new heights.

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:
[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:
[SS],[C*]
In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:
:CC=2*[PI]*R:
Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10   :LN=70   :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

Lower Case

Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]	£	
[LARROW]	←	
[UPARROW]	↑	
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

PROGRAM: TIMER

```
76   100 POKE53280,0:POKE53281,0:
     PRINT"[CLR]";
FA   110 PRINT"[C5,SU,S*38,SI]";
50   120 PRINT"[S-,SPC3,GREEN,CA,
     CR,CS,SU,SC,SI,CA,SC,SI,CA,S
     C,CS] [SU,SC,SI,SU] [SI,SU,
     SC,SI,CA,CR,CS,CA,SC,CS,CA,C
     R,SI,C5,SPC3,S-]";
54   130 PRINT"[SB,SPC3,GREEN] [S
     B,SSPC,CQ,SC,CW,CQ,SC,SK,CQ,
     SC,SPC3,SJ,SC,SI,SJ,CR,SK,SJ
     ,SC,SI] [SB] [CQ,SC] [SB3,CS
     ,SPC3,S-]";
72   140 PRINT"[S-,SPC3,GREEN] [C
     E] [CE] [CE2] [CZ,SC,CX] [
     SJ,SC,SK] [CE] [SJ,SC,SK] [C
     E] [CZ,SC,CX,CE] [CE,C5,SPC3
     ,S-]";
AA   150 PRINT"[CQ,S*38,CW]";
ED   160 PRINT"[S-,SPC11,C3]TAPE
     SPOOL-TIMER[C5,SPC11,S-]";
83   170 PRINT"[SJ,S*38,SK]";
0D   180 PRINT"[DOWN14]"
82   190 PRINT"[SU,S*38,SI]";
B2   200 PRINT"[C8,S-]'F1' - EXIT
     [SPC6,GREEN](C)R.KYME-WRIGHT
     1987[C5,S-]";
7B   210 PRINT"[SJ,S*38,UP11]";
57   220 POKE2023,75:POKE56295,12
A2   230 PRINT"[UP6,C1]"
A6   240 PRINT"[SPC4]PRESS THE FF
     WD KEY OR THE REWIND[SPC4]"
DA   250 PRINT"[SPC4]KEY THEN TOU
     CH THE  SPACE-BAR TO[SPC4]"
5F   260 PRINT"[SPC4]START SPOOLI
     NG THE TAPE.[SPC3]PRESS[SPC4
     ]"
F7   270 PRINT"[SPC4]THE SPACE-BA
     R AGAIN TO  STOP THE[SPC4]"
3F   280 PRINT"[SPC4]TAPE WHEN TH
     E NEXT COUNTER VALUE[SPC4]"
B6   290 PRINT"[SPC4]IS REACHED.
      NOTE DOWN THE TIMER[SPC4]"
7E   300 PRINT"[SPC4]VALUE ON YOU
     R CHART.[SPC16]":POKE198,0
7B   310 GETA1$:K=ASC(A1$+CHR$(0)
     )
6F   320 IFK=133THENPRINT"[CLR]":
     GOTO760
86   330 IF(PEEK(1))=55THEN710
A1   340 IFK<>32THEN310
10   350 PRINT"[UP14,C5,SPC40]"
D9   360 PRINT"[C5,SPC14]TIMER V
     ALUE[SPC14,C1]"
3B   370 PRINT"[SPC15,CA,SC8,CS,S
     PC15]";
A3   380 PRINT"[SPC15,SB,SPC8,SB,
     SPC15]";
62   390 PRINT"[SPC15,CZ,SC8,CX,S
     PC15]"
08   400 PRINT"[SPC40]"
06   410 PRINT"[SPC40]"
B7   420 PRINT"[SPC40]";
40   430 PRINT"[UP8,RIGHT25,CYAN]
     ";:POKE198,0
27   440 TX=TI:POKE1,7
E7   450 TY=TI:TZ=TY-TX
82   460 LN=LEN(STR$(TZ)):ONLNGOT
     O470,480,490,500,510,520,530
BB   470 PRINT"[LEFT2]";:GOTO540
AC   480 PRINT"[LEFT3]";:GOTO540
D1   490 PRINT"[LEFT4]";:GOTO540
4E   500 PRINT"[LEFT5]";:GOTO540
17   510 PRINT"[LEFT6]";:GOTO540
83   520 PRINT"[LEFT7]";:GOTO540
32   530 PRINT"[LEFT8]";:GOTO540
BC   540 PRINTTZ;
3D   550 GETA1$:K=ASC(A1$+CHR$(0)
     )
E0   560 IFK=133THENPRINT"[CLR]":
     GOTO760
9D   570 IFK<>32THEN450
58   580 POKE1,39
17   590 PRINT:PRINT"[DOWN3,C1,SP
     C3]PRESS RETURN KEY TO RESET
      THE TIMER":POKE198,0
1B   600 GETA1$:K=ASC(A1$+CHR$(0)
     )
0B   610 IFK=13THEN640
0C   620 IFK=133THENPRINT"[CLR]":
     GOTO760
47   630 GOTO600
00   640 PRINT"[UP,C7,SPC9]READY
     FOR NEXT INTERVAL[SPC7,CYAN]
     ";
4E   650 PRINT"[UP5,RIGHT17,SPC7]
     0[RIGHT]";:POKE198,0
B7   660 GETA1$:K=ASC(A1$+CHR$(0)
     )
A2   670 IFK=133THENPRINT"[CLR]":
     GOTO760
29   680 IF(PEEK(1))=55THEN710
04   690 IFK<>32THEN660
38   700 TX=TI:POKE1,7:GOTO450
5B   710 FORX=0TO104:POKE53270,X:
     POKE54296,15:POKE54296,7:NEX
     T
EE   720 PRINT"[CLR,DOWN,C1]  ERR
     OR - THE CASSETTE UNIT IS NO
      LONGER"
48   730 PRINT"[SPC10]UNDER PROGR
     AM CONTROL."
F2   740 PRINT"[DOWN3,SPC10]PLEAS
     E RELOAD 'TIMER'."
DD   750 PRINT"[DOWN] (DO NOT US
     E THE CASSETTE 'STOP' KEY.)[
     DOWN3]"
58   760 NEW
```

PROGRAM: SPOOLER

```
9F   10 C=0:POKE53280,C:POKE53281
     ,C:PRINT"[CLR]";:GOTO18
51   11 PRINT"[C5,SU,S*38,SI]";
EE   12 PRINT"[C5,S-,SPC3,CA,CR,C
     S,SU,SC,SI,CA,SC,SI,CA,SC,CS
     ] [SU,SC,SI,SU] [SI,SU,SC,S
     I,CA,CR,CS,CA,SC,CS,CA,CR,SI
     ,SPC3,S-]";
97   13 PRINT "[S-,SPC4,SB,SSPC,C
     Q,SC,CW,CQ,SC,SK,CQ,CW,SPC3,
     SJ,SC,SI,SJ,CR,SK,SJ,SC,SI]
     [SB] [CQ,CW] [SB,S-,SB,SPC3,
     S-]";
8A   14 PRINT "[S-,SPC4,CE] [CE]
     [CE2]  [CZ,SC,CX]  [SJ,SC,SK
     ] [CE] [SJ,SC,SK] [CE] [CZ,S
     C,CX,CE] [CE,SPC3,S-]";
85   15 PRINT"[S-,C3,C@38,C5,S-]"
     ;
BF   16 PRINT"[S-,C3,RVSON] TYPE
     IN A SUITABLE GENERAL TITLE
     HERE[RVSOFF,C5,S-]";
4D   17 PRINT"[SJ,S*38,SK]":RETUR
     N
5F   18 DIMW$(6),D(6),E(6)
16   19 FORX=1TO6:READW$(X),E(X):
     NEXT:FORX=1TO6:READD(X):NEXT
DE   20 GOSUB11:GOSUB71
42   21 POKE211,1:POKE214,19:SYS5
     8732
FF   22 PRINT:PRINT"[DOWN,C7,SPC1
     0]"
BD   23 PRINT"   SELECT AND TYPE I
     N A PROGRAM NUMBER[SPC3,LEFT
     3]";:POKE198,0
4B   24 GETK$:IFK$=""THEN24
DC   25 K=ASC(K$+CHR$(0))-48:IF(K
     >0)AND(K<7)THEN30
ED   26 PRINT"[LEFT14,C4]PROGRAM
     NUMBER[C7]";:FORX=1TO140:NEX
     T
81   27 PRINT"[LEFT14]PROGRAM NUM
     BER";:FORX=1TO140:NEXT
F2   28 GETK$:IFK$=""THENK$="0"
F3   29 GOTO25
E0   30 IFE(K)=0THEN21
5C   31 PRINT"[HOME,DOWN6]":FORX=
     1TOK:PRINT"[DOWN2]";:NEXT
4E   32 PRINT"[UP,SPC5,YELLOW,C@3
     0]"
1A   33 PRINT"[UP,SPC5,RVSON]";W$
     (K);"[RVSOFF,HOME,DOWN21]"
C5   34 IFE(K)=8THENPRINT"[HOME]"
     ;:GOTO19
F3   35 IFE(K)=9THENRESTORE:PRINT
     "[HOME]";:GOTO19
DF   36 IFD(K)=0THEN43
46   37 IFPEEK(1)=55THEN67
32   38 IFD(K)>0THEN41
84   39 DK=D(K)*-1:PRINT"[UP,C3,S
     PC7,C@8]"
D2   40 PRINT"[C7]ENGAGE [C3,RVSO
     N] REWIND [RVSOFF,C7] THEN P
     RESS THE SPACE BAR[UP]":GOTO
     45
A0   41 DK=D(K):PRINT"[UP,GREEN,S
     PC7,C@7] "
67   42 PRINT"[C7]ENGAGE [GREEN,R
     VSON] F.FWD [RVSOFF,C7] THEN
      PRESS THE SPACE BAR ":GOTO4
     5
65   43 PRINT"[UP,GREEN,SPC15]"
6A   44 PRINT"[C7,SPC4]PRESS THE
     SPACE BAR TO CONTINUE[SPC5]"
56   45 POKE198,0
8E   46 IF(PEEK(1)=55)AND(D(K)<>0
     )THEN67
6C   47 GETA$:IFA$=""THEN46
37   48 A=ASC(A$+CHR$(0))-48:IFA=
     -16THEN51
71   49 IF(A<1)OR(A>6)THEN47
CE   50 K=A:PRINT"[HOME,DOWN8]";:
     GOSUB71:GOTO30
95   51 POKE1,39:IFD(K)=0THEN57
2B   52 PRINT"[UP3,SPC15]":PRINT"
     [C1,SPC9,YELLOW]PLEASE WAIT.
     .......[SPC12]"
3C   53 T=TI+DK:POKE1,7
67   54 IFTI<TTHEN54
2F   55 POKE1,39:PRINT"[UP2,C7,SP
     C6]PRESS STOP ON THE TAPE DR
     IVE"
BF   56 IFPEEK(1)<>55THEN56
54   57 PRINT"[CLR]";:GOSUB11:PRI
     NT"[UP4,S-,C1,C@38,C5,S-]";
FC   58 PRINT"[S-,C1,RVSON,SPC4]"
     ;W$(K);"[SPC4,RVSOFF,DOWN2]"
     :POKE646,C
FD   59 ONE(K)GOTO60,61,62,63,64,
     65,66
C0   60 PRINT"[DOWN,C7]HOLD DOWN
     SHIFT-KEY AND PRESS RUN/STOP
     ":GOTO73
```

```
3F   61 PRINT"[DOWN]LOAD"CHR$(34)
     CHR$(34)",1,1[C7,UP4]":POKE1
     98,1:POKE631,13:GOTO73
DF   62 PRINT"[DOWN]LOAD"CHR$(34)
     CHR$(34)",7[C7,UP4]":POKE198
     ,1:POKE631,13:GOTO73
05   63 :
7A   64 :
7B   65 :
78   66 :
AC   67 FORX=0TO104:POKE53270,X:P
     OKE54296,15:POKE54296,7:NEXT
8E   68 PRINT"[CLR,DOWN2,C1]FATAL
      ERROR  [S*3]  STOP-KEY HAS
     BEEN USED[DOWN2]"
BD   69 PRINT"[C7,SPC5]REWIND THE
      TAPE FOR 5 COUNTS[DOWN]"
1C   70 PRINT"[SPC6]AND LOAD THIS
      PROGRAM AGAIN[C1,DOWN2]":GO
     TO73
81   71 FORX=1TO6:PRINT"[RVSOFF,C
     1,RIGHT5,C@30,SPC5]";
ED   72 PRINT"[RVSON,RIGHT5]";W$(
     X):NEXT:RETURN
EB   73 NEW
C0   74 DATA" 1:[SPC27]",0
C0   75 DATA" 2:[SPC27]",0
D8   76 DATA" 3:[SPC27]",0
D8   77 DATA" 4:[SPC27]",0
D8   78 DATA" 5:[SPC27]",0
D8   79 DATA" 6:[SPC27]",0
59   80 DATA+0000,+0000,+0000,+00
     00,+0000,+0000
```

PROGRAM: LOADER.1

```
85   10 REM****************
C9   20 REM*   LOADER 1   *
11   30 REM*   SPRITES    *
C7   40 REM****************
99   2000 FORL=0TO156:CX=0:FORD=0
     TO15:READA:CX=CX+A:POKE12288
     +L*16+D,A:NEXTD
82   2010 READA:IFA<>CXTHENPRINT"
     ERROR IN LINE";2040+(L*10):S
     TOP
0F   2020 NEXTL:END
CE   2040 DATA0,0,0,3,192,32,15,2
     40,80,31,248,144,31,249,16,5
     1,1332
10   2050 DATA205,144,33,133,80,3
     6,37,32,19,201,0,24,25,0,7,2
     25,1201
82   2060 DATA0,63,253,0,127,255,
     0,151,239,0,103,231,0,15,252
     ,128,1817
58   2070 DATA12,123,128,12,0,0,3
     0,0,0,30,0,0,0,0,0,80,415
E3   2080 DATA0,0,0,3,192,32,15,2
     40,80,31,248,144,31,249,16,5
     1,1332
98   2090 DATA205,144,33,133,80,3
     6,37,32,19,201,0,24,25,0,7,2
     25,1201
C7   2100 DATA0,63,253,0,127,255,
     0,247,239,0,151,231,0,111,24
     4,128,2049
26   2110 DATA12,123,128,12,120,0
     ,30,0,0,30,0,0,0,0,0,80,535
BB   2120 DATA0,0,0,3,192,32,15,2
     40,80,31,248,144,31,249,16,5
     1,1332
20   2130 DATA205,144,33,133,80,3
     6,37,32,19,201,0,24,25,0,7,2
     25,1201
24   2140 DATA0,63,253,0,127,255,
     0,119,239,0,103,231,0,159,24
     4,128,1921
B8   2150 DATA108,51,128,12,48,0,
     30,120,0,30,120,0,0,0,0,80,7
     27
13   2160 DATA0,0,0,3,192,32,15,2
     40,80,31,248,144,31,249,16,5
     1,1332
68   2170 DATA205,144,33,133,80,3
     6,37,32,19,201,0,24,25,0,7,2
     25,1201
4C   2180 DATA0,63,253,0,127,255,
     0,103,239,0,151,231,0,111,24
     4,128,1905
05   2190 DATA12,51,128,30,48,0,3
     0,120,0,0,120,0,0,0,0,80,619
2B   2200 DATA0,0,0,3,192,32,15,2
     40,80,31,248,144,31,249,16,5
     1,1332
F0   2210 DATA205,144,33,133,80,3
     6,37,32,19,201,0,24,25,0,7,2
     25,1201
C6   2220 DATA0,63,253,0,127,255,
     0,151,239,0,103,231,0,15,244
     ,128,1809
43   2230 DATA30,51,128,30,48,0,0
     ,120,0,0,120,0,0,0,0,80,607
A0   2240 DATA0,0,0,64,60,0,160,2
     55,0,145,255,128,137,255,128
     ,155,1742
3F   2250 DATA255,192,171,255,192
     ,75,255,192,9,255,128,9,255,
     128,8,126,2505
E1   2260 DATA0,11,255,192,15,255
     ,224,15,126,144,14,126,96,19
     ,255,0,1747
59   2270 DATA29,227,0,0,3,0,0,7,
     128,0,7,128,0,0,0,80,609
B8   2280 DATA0,0,0,64,60,0,160,2
     55,0,145,255,128,137,255,128
     ,155,1742
C7   2290 DATA255,192,171,255,192
     ,75,255,192,9,255,128,9,255,
     128,8,126,2505
E7   2300 DATA0,11,255,192,15,255
     ,224,15,126,96,14,126,144,18
     ,255,96,1842
AD   2310 DATA29,227,0,1,227,0,0,
     7,128,0,7,128,0,0,0,80,834
8F   2320 DATA0,0,0,64,60,0,160,2
     55,0,145,255,128,137,255,128
     ,155,1742
60   2330 DATA255,192,171,255,192
     ,75,255,192,9,255,128,9,255,
     128,8,126,2505
B0   2340 DATA0,11,255,192,15,255
     ,224,15,126,96,14,126,96,18,
     255,144,1842
18   2350 DATA28,195,96,0,195,0,1
     ,231,128,1,231,128,0,0,0,80,
     1314
87   2360 DATA0,0,0,64,60,0,160,2
     55,0,145,255,128,137,255,128
     ,155,1742
E8   2370 DATA255,192,171,255,192
     ,75,255,192,9,255,128,9,255,
     128,8,126,2505
50   2380 DATA0,11,255,192,15,255
     ,224,15,126,96,14,126,144,18
     ,255,96,1842
91   2390 DATA28,195,0,0,199,128,
     1,231,128,1,224,0,0,0,0,80,1
     215
3F   2400 DATA0,0,0,64,60,0,160,2
     55,0,145,255,128,137,255,128
     ,155,1742
90   2410 DATA255,192,171,255,192
     ,75,255,192,9,255,128,9,255,
     128,8,126,2505
36   2420 DATA0,11,255,192,15,255
     ,224,15,126,144,14,126,96,18
     ,255,0,1746
04   2430 DATA28,199,128,0,199,12
     8,1,224,0,1,224,0,0,0,0,80,1
     212
DD   2440 DATA0,0,0,0,28,0,0,127,
     0,0,255,128,1,255,192,1,987
3A   2450 DATA248,64,1,240,64,1,2
     44,64,1,243,192,1,240,64,0,1
     27,1794
79   2460 DATA0,0,255,128,0,255,1
     28,0,255,128,0,255,128,0,127
     ,0,1659
E3   2470 DATA0,62,128,0,223,192,
     1,207,128,1,239,0,1,198,0,11
     2,1492
95   2480 DATA0,0,0,0,28,0,0,127,
     0,0,255,128,1,255,192,1,987
D2   2490 DATA248,64,1,240,64,1,2
     44,64,1,243,192,1,240,64,0,1
     27,1794
F1   2500 DATA0,0,255,128,0,255,1
     28,0,255,128,0,255,128,0,127
     ,0,1659
48   2510 DATA0,126,0,0,191,128,0
     ,223,128,0,239,0,0,110,0,112
     ,1257
0D   2520 DATA0,0,0,0,28,0,0,127,
     0,0,255,128,1,255,192,1,987
CA   2530 DATA248,64,1,240,64,1,2
     44,64,1,243,192,1,240,64,0,1
     27,1794
29   2540 DATA0,0,255,128,0,255,1
     28,0,255,128,0,255,128,0,127
     ,0,1659
0F   2550 DATA0,60,0,0,60,0,0,60,
     0,0,63,0,0,63,0,112,418
BC   2560 DATA0,0,0,0,28,0,0,127,
     0,0,255,128,1,255,192,1,987
7D   2570 DATA248,64,1,240,64,1,2
     44,64,1,243,192,1,240,64,0,1
     27,1794
6E   2580 DATA0,0,255,128,0,255,1
     28,0,255,128,0,255,128,0,127
     ,0,1659
CB   2590 DATA0,30,0,0,125,0,0,24
     7,128,0,239,128,0,110,0,112,
     1119
74   2600 DATA0,0,0,0,28,0,0,127,
     0,0,255,128,1,255,192,1,987
F5   2610 DATA248,64,1,240,64,1,2
     44,64,1,243,192,1,240,64,0,1
     27,1794
26   2620 DATA0,0,255,128,0,255,1
     28,0,255,128,0,255,128,0,127
     ,0,1659
CE   2630 DATA0,62,0,0,249,192,1,
     247,192,1,207,0,1,134,0,112,
     1398
30   2640 DATA0,0,0,0,56,0,0,254,
     0,1,255,0,3,255,128,2,954
2C   2650 DATA31,128,2,15,128,2,4
     7,128,3,207,128,2,15,128,0,2
     54,1218
5C   2660 DATA0,1,255,0,1,255,0,1
     ,255,0,1,255,0,0,254,0,1278
66   2670 DATA1,124,0,3,251,0,1,2
     43,128,0,247,128,0,99,128,11
     2,1465
D8   2680 DATA0,0,0,0,56,0,0,254,
     0,1,255,0,3,255,128,2,954
A4   2690 DATA31,128,2,15,128,2,4
     7,128,3,207,128,2,15,128,0,2
     54,1218
34   2700 DATA0,1,255,0,1,255,0,1
     ,255,0,1,255,0,0,254,0,1278
31   2710 DATA0,126,0,1,253,0,1,2
     51,0,0,247,0,0,118,0,64,1061
80   2720 DATA0,0,0,0,56,0,0,254,
     0,1,255,0,3,255,128,2,954
BC   2730 DATA31,128,2,15,128,2,4
     7,128,3,207,128,2,15,128,0,2
```

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    54,1218
8C  2740 DATA0,1,255,0,1,255,0,1
    ,255,0,1,255,0,0,254,0,1278
44  2750 DATA0,60,0,0,60,0,0,60,
    0,0,252,0,0,252,0,64,748
A8  2760 DATA0,0,0,56,0,0,254,
    0,1,255,0,3,255,128,2,954
34  2770 DATA31,128,2,15,128,2,4
    7,128,3,207,128,2,15,128,0,2
    54,1218
E4  2780 DATA0,1,255,0,1,255,0,1
    ,255,0,1,255,0,0,254,0,1278
8C  2790 DATA0,120,0,0,190,0,1,2
    39,0,1,247,0,0,118,0,64,980
D0  2800 DATA0,0,0,56,0,0,254,
    0,1,255,0,3,255,128,2,954
8C  2810 DATA31,128,2,15,128,2,4
    7,128,3,207,128,2,15,128,0,2
    54,1218
91  2820 DATA0,1,255,0,1,255,0,1
    ,255,0,1,255,0,0,254,0,1278
B0  2830 DATA0,124,0,3,159,0,3,2
    39,128,0,243,128,0,97,128,40
    ,1292
E5  2840 DATA0,0,0,0,0,0,0,0,4
    ,0,32,14,0,112,31,193
02  2850 DATA0,248,63,129,252,10
    3,165,230,163,255,197,3,219,
    192,5,255,2479
C5  2860 DATA160,1,126,128,0,231
    ,0,0,219,0,0,66,0,0,66,0,997
6E  2870 DATA0,195,0,1,36,128,0,
    0,0,0,0,0,0,0,0,40,400
D8  2880 DATA0,0,0,0,0,0,85,0,
    1,85,64,5,85,64,5,394
FA  2890 DATA85,64,7,87,64,7,87,
    80,5,85,80,5,85,80,37,85,943
F9  2900 DATA80,37,85,84,37,86,8
    4,37,154,88,38,170,152,42,16
    9,168,1511
B3  2910 DATA174,174,168,174,175
    ,172,191,179,236,243,192,240
    ,0,0,0,191,2509
91  2920 DATA0,0,0,0,0,0,0,0,0
    ,32,0,0,32,0,8,72
99  2930 DATA8,0,2,38,0,2,38,128
    ,2,166,0,2,150,0,2,154,692
7E  2940 DATA0,2,153,128,2,105,1
    28,2,105,136,2,105,160,2,105
    ,152,1287
7F  2950 DATA10,89,152,9,85,96,9
    ,125,88,47,195,252,0,0,0,255
    ,1412
75  2960 DATA0,0,0,0,0,0,32,0,
    0,184,0,2,150,0,0,368
0A  2970 DATA86,0,0,22,0,0,22,0,
    0,22,0,0,24,0,0,24,200
A0  2980 DATA0,0,24,0,0,24,0,0,2
    4,32,10,170,128,32,96,0,540
86  2990 DATA33,128,0,10,0,0,0,0
    ,0,0,0,0,0,0,0,183,354
46  3000 DATA0,0,0,112,96,14,9
    ,152,16,2,4,0,98,4,16,523
B3  3010 DATA0,4,40,0,8,64,0,212
    ,67,192,34,72,0,34,16,8,751
5A  3020 DATA32,0,28,40,10,8,68,
    0,0,4,64,0,4,68,4,8,338
26  3030 DATA66,8,34,49,244,34,4
    ,3,210,2,32,12,1,192,0,255,1
    146
F7  3040 DATA0,0,0,0,0,0,0,0,0
    ,149,86,2,255,148,0,640
CD  3050 DATA149,96,2,95,244,15,
    245,80,2,85,64,0,95,224,0,53
    ,1449
5D  3060 DATA64,0,11,244,0,2,80,
    0,15,64,0,9,240,0,3,148,880
5D  3070 DATA0,1,112,0,1,192,0,0
    ,80,0,0,20,0,0,0,255,661
93  3080 DATA12,21,0,12,85,64,4,
    68,64,4,68,64,4,85,64,7,626
3F  3090 DATA255,240,7,245,80,7,
    246,144,7,245,144,7,245,144,
    7,245,2268
35  3100 DATA144,4,245,144,4,246
    ,144,4,245,80,4,161,64,4,162
    ,128,1783
BD  3110 DATA4,162,128,4,128,128
    ,6,128,160,6,128,160,0,0,0,2
    55,1397
0D  3120 DATA0,36,0,0,40,8,0,118
    ,18,0,248,20,0,246,60,0,794
CC  3130 DATA248,112,0,244,254,1
    ,249,248,1,243,254,1,231,240
    ,1,239,2566
FF  3140 DATA252,11,255,224,31,2
    55,144,33,254,0,0,252,0,0,25
    4,0,1965
4F  3150 DATA0,127,128,0,255,224
    ,1,15,192,7,3,128,8,128,0,18
    3,1399
36  3160 DATA0,4,0,0,4,0,0,20,0,
    0,20,0,0,20,12,0,80
0C  3170 DATA40,12,0,40,12,0,85,
    12,5,85,76,9,85,76,5,93,635
C0  3180 DATA92,5,85,88,1,85,88,
    1,213,92,1,85,28,1,85,12,962
E0  3190 DATA1,85,12,1,87,76,3,8
    5,76,5,85,92,0,0,0,255,863
3F  3200 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
5A  3210 DATA0,0,240,20,0,240,40
    ,0,240,40,0,49,85,64,49,85,1
    152
37  3220 DATA64,53,85,64,53,85,6
    4,36,85,64,0,85,128,0,85,0,9
    51
B7  3230 DATA0,65,0,0,65,0,3,65,
    192,3,195,192,0,0,0,191,971
D2  3240 DATA1,0,64,3,0,64,1,20,
    64,1,28,192,1,20,64,1,524
E7  3250 DATA85,64,1,221,64,0,85
    ,0,0,93,0,0,85,0,0,247,945
EF  3260 DATA0,0,87,0,0,119,0,0,
    77,0,0,77,0,0,65,0,425
7D  3270 DATA0,67,0,1,67,64,1,65
    ,64,0,0,0,0,0,0,255,584
8F  3280 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
B3  3290 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,7,7
69  3300 DATA224,0,15,240,0,24,2
    4,0,24,24,0,24,24,0,24,24,67
    1
E4  3310 DATA7,216,24,15,236,48,
    24,54,96,48,31,255,48,31,255
    ,182,1570
50  3320 DATA48,31,255,48,31,255
    ,24,54,96,15,236,48,7,216,24
    ,0,1388
0E  3330 DATA24,24,0,24,24,0,24,
    24,0,24,24,0,15,240,0,7,454
3A  3340 DATA224,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,224
18  3350 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,64,64
DE  3360 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
E4  3370 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
F2  3380 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
7C  3390 DATA0,0,0,0,0,0,0,0,2
    55,255,252,255,255,252,24,15
    48
DA  3400 DATA255,255,252,255,255
    ,252,0,7,248,0,3,240,0,3,240
    ,0,2265
0B  3410 DATA7,248,0,6,216,0,6,2
    16,0,0,0,0,0,0,0,0,699
1A  3420 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
20  3430 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
A8  3440 DATA0,0,0,0,112,96,14,9
    ,152,16,2,4,0,98,4,16,523
B9  3450 DATA0,4,40,0,8,64,0,212
    ,67,192,34,72,0,34,16,8,751
78  3460 DATA32,0,28,40,10,8,68,
    0,0,4,64,0,4,68,4,8,338
5B  3470 DATA66,8,34,49,244,34,4
    ,3,210,2,32,12,1,192,0,32,92
    3
E9  3480 DATA0,0,0,0,0,0,0,0,0
    ,28,0,0,34,0,15,77
F9  3490 DATA161,0,16,91,0,16,68
    ,128,19,4,128,8,1,64,7,16,72
    7
C7  3500 DATA32,2,12,32,4,210,64
    ,4,33,128,3,210,128,0,140,12
    8,1130
69  3510 DATA0,152,128,0,103,0,0
    ,0,0,0,0,0,0,0,0,169,552
7E  3520 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
1C  3530 DATA0,0,0,118,0,0,137,0
    ,3,136,128,4,86,128,4,129,87
    3
76  3540 DATA0,2,145,0,1,110,0,0
    ,0,0,0,0,0,0,0,0,258
9C  3550 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,2,2
A6  3560 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
22  3570 DATA0,0,0,0,0,0,16,0,0,
    2,0,0,40,0,0,0,58
8A  3580 DATA0,0,8,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,8
4D  3590 DATA0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,76,76
5A  3600 DATA0,104,0,40,0,104,2,
    104,0,104,0,106,0,104,0,104,
    772
```

PROGRAM: LOADER.2

```
AF  10 REM******************
DC  20 REM*   LOADER.2     *
C2  30 REM* CHARACTER SET *
F1  40 REM******************
04  2000 FORL=0TO128:CX=0:FORD=0
    TO15:READA:CX=CX+A:POKE10240
    +L*16+D,A:NEXTD
82  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
3F  2040 DATA0,0,0,0,0,0,0,0,231
    ,219,189,129,189,189,189,255
    ,1590
40  2050 DATA131,189,189,131,189
    ,189,131,255,195,189,191,191
    ,191,189,195,255,3000
D1  2060 DATA135,187,189,189,189
    ,187,135,255,129,191,191,135
    ,191,191,129,255,2878
FD  2070 DATA129,191,191,135,191
    ,191,191,255,195,189,191,177
    ,189,189,195,255,3054
33  2080 DATA189,189,189,129,189
    ,189,189,255,199,239,239,239
    ,239,239,199,255,3366
```

```
A0 2090 DATA227,247,247,247,247
,183,207,255,187,183,175,159
,175,183,187,255,3364
0D 2100 DATA191,191,191,191,191
,191,129,255,190,156,170,182
,190,190,190,255,3053
48 2110 DATA221,221,205,213,217
,221,221,255,195,189,189,189
,189,189,195,255,3364
39 2120 DATA131,189,189,131,191
,191,191,255,195,189,189,189
,165,181,193,255,3024
80 2130 DATA131,189,189,131,183
,187,189,255,195,189,191,195
,253,189,195,255,3116
FE 2140 DATA131,239,239,239,239
,239,239,255,189,189,189,189
,189,189,195,255,3404
1A 2150 DATA189,189,189,189,189
,219,231,255,190,190,190,182
,170,156,190,255,3173
F9 2160 DATA189,219,231,231,219
,189,189,255,221,221,221,227
,247,247,247,255,3608
FB 2170 DATA129,253,251,247,239
,223,129,255,255,255,255,255
,15,15,15,15,2806
06 2180 DATA255,255,221,235,247
,235,221,255,15,15,15,15,15,
15,15,15,2044
DA 2190 DATA15,15,15,15,255,255
,255,255,240,240,240,240,255
,255,255,255,3060
C4 2200 DATA255,255,255,255,255
,255,255,255,0,0,0,0,255,255
,255,255,3060
A8 2210 DATA102,102,102,0,0,0,0
,0,240,0,240,0,255,0,255,0,1
296
2E 2220 DATA0,0,0,0,255,0,255,0
,15,15,15,15,255,7,255,1,108
8
FD 2230 DATA60,102,60,56,103,10
2,63,0,6,12,24,0,0,0,0,0,588
83 2240 DATA255,255,255,31,31,3
1,31,31,31,31,31,31,31,31,31
,31,1168
BE 2250 DATA31,31,31,255,255,25
5,255,255,0,0,0,255,255,255,
255,255,2643
FC 2260 DATA240,240,240,255,255
,255,255,255,240,240,240,255
,255,255,255,255,3990
AB 2270 DATA255,255,255,255,207
,207,255,255,0,3,6,12,24,48,
96,0,2133
E2 2280 DATA227,221,221,221,221
,221,227,255,247,231,247,247
,247,247,227,255,3762
97 2290 DATA195,187,251,247,239
,223,131,255,195,189,253,227
,253,189,195,255,3484
B1 2300 DATA249,245,237,221,128
,253,253,255,129,191,131,253
,253,189,195,255,3437
E7 2310 DATA195,189,191,131,189
,189,195,255,129,189,251,247
,239,239,239,255,3322
62 2320 DATA195,189,189,195,189
,189,195,255,195,189,189,193
,253,189,195,255,3254
8C 2330 DATA255,255,231,255,255
,231,255,255,0,0,24,0,0,24,2
4,48,2112
64 2340 DATA14,24,48,96,48,24,1
4,0,255,255,129,255,129,255,
255,255,2056
5E 2350 DATA112,24,12,6,12,24,1
12,0,195,189,253,243,239,255
,239,255,2170
F2 2360 DATA0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0
F8 2370 DATA0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0
06 2380 DATA0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0
0C 2390 DATA0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0
38 2400 DATA224,239,224,248,251
,251,253,253,0,255,0,0,255,2
55,255,255,3218
74 2410 DATA7,247,7,31,223,223,
191,191,254,255,255,255,255,
255,255,254,3158
60 2420 DATA255,126,189,219,219
,153,0,0,127,255,255,255,255
,255,255,127,2945
0B 2430 DATA252,252,248,248,248
,224,239,224,0,0,0,0,63,0,25
5,0,2253
86 2440 DATA63,63,31,31,31,7,19
9,7,224,60,126,126,126,126,6
0,0,1280
9E 2450 DATA255,254,253,253,251
,251,251,251,255,255,127,159
,233,244,252,228,3772
67 2460 DATA255,255,255,255,255
,255,255,255,253,253,254,255
,255,255,255,255,4075
10 2470 DATA132,4,4,52,116,244,
244,244,255,255,255,255,255,
255,255,255,3080
5E 2480 DATA255,255,255,255,255
,255,255,255,244,244,244,244
,244,240,252,255,4007
28 2490 DATA255,255,255,255,255
,255,255,255,255,255,255,252
,227,223,239,247,3993
82 2500 DATA255,255,255,36,195,
231,231,231,255,255,255,63,1
99,251,247,239,3453
09 2510 DATA251,253,254,255,255
,255,255,255,231,231,231,102
,165,195,231,231,3650
D4 2520 DATA223,191,127,255,255
,255,255,255,255,255,255,255
,255,255,255,255,3856
9E 2530 DATA231,231,231,231,255
,255,255,255,255,255,255,255
,255,255,255,255,3984
17 2540 DATA255,255,255,249,250
,251,251,251,255,255,255,231
,219,60,254,189,3735
EF 2550 DATA255,255,255,159,79,
199,199,199,253,253,253,253,
253,254,254,254,3627
07 2560 DATA27,183,238,221,187,
119,235,209,199,7,143,143,14
3,15,31,31,2131
62 2570 DATA255,255,255,255,255
,255,255,255,58,188,192,240,
255,255,255,255,3738
47 2580 DATA63,63,127,255,255,2
55,255,255,255,255,255,255,2
55,255,255,255,3568
19 2590 DATA239,215,211,211,211
,211,211,211,255,255,255,255
,255,255,255,255,3760
9D 2600 DATA255,255,255,255,255
,255,255,255,211,211,211,211
,211,211,211,211,3728
1C 2610 DATA255,255,255,255,255
,255,255,255,253,254,255,255
,255,255,255,255,4077
57 2620 DATA211,0,16,211,211,21
1,195,227,127,127,255,255,25
5,255,255,255,3066
90 2630 DATA7,7,7,7,7,7,7,7,255
,255,0,0,0,0,0,0,566
AE 2640 DATA255,255,255,0,0,0,0
,0,0,0,0,0,0,255,255,255,153
0
4A 2650 DATA3,3,3,3,3,3,255,255
,0,0,0,0,240,240,240,240,148
8
03 2660 DATA15,15,15,15,0,0,0,0
,24,24,24,248,248,0,0,0,628
81 2670 DATA240,240,240,240,0,0
,0,0,240,240,240,240,15,15,1
5,15,1980
B5 2680 DATA170,234,170,174,169
,167,159,159,170,149,127,127
,255,255,119,223,2827
6F 2690 DATA170,174,106,218,246
,218,246,222,127,127,159,125
,151,157,151,165,2762
26 2700 DATA255,255,255,255,119
,221,119,245,255,245,255,253
,246,90,106,170,3344
C9 2710 DATA169,169,234,174,169
,169,187,170,246,86,86,86,86
,85,101,170,2387
A0 2720 DATA170,186,170,174,170
,234,171,186,170,170,234,171
,170,170,174,170,2890
71 2730 DATA255,223,253,127,253
,246,218,214,255,223,245,218
,90,169,169,169,3327
CA 2740 DATA223,255,119,159,151
,85,105,170,255,125,255,223,
255,255,119,159,2913
75 2750 DATA214,213,197,241,240
,124,255,223,165,85,80,64,0,
63,223,253,2640
0B 2760 DATA106,85,85,21,0,195,
255,247,95,95,79,61,255,255,
119,255,2208
BB 2770 DATA127,251,255,255,223
,255,254,191,255,239,253,255
,127,251,255,255,3701
7A 2780 DATA191,245,218,218,214
,197,240,191,251,127,157,157
,89,72,25,255,2847
DF 2790 DATA255,253,95,167,167,
83,15,255,255,255,189,246,24
6,218,218,245,3162
EF 2800 DATA223,255,127,159,167
,169,169,170,239,255,255,127
,255,255,251,127,3203
D5 2810 DATA253,255,255,239,255
,255,255,95,245,245,241,177,
252,255,247,255,3779
7F 2820 DATA170,106,85,85,85,0,
255,255,125,93,93,64,8,170,2
55,255,2104
C3 2830 DATA167,169,85,85,20,13
1,255,255,127,255,235,254,25
5,175,255,245,2968
2B 2840 DATA175,255,215,255,254
,235,255,127,127,255,235,254
,215,255,191,235,3538
41 2850 DATA0,85,85,85,0,85,85,
85,0,64,80,64,0,64,80,64,926
F9 2860 DATA0,60,60,60,0,60,60,
60,0,60,60,60,0,60,60,60,720
E4 2870 DATA0,60,60,0,20,20,20,
20,171,234,170,174,0,85,85,8
5,1204
EE 2880 DATA171,234,170,186,0,6
4,80,64,171,175,171,190,255,
175,255,245,2606
F8 2890 DATA175,255,215,254,254
,234,250,106,170,170,170,170
,171,171,175,191,3131
30 2900 DATA254,250,234,234,170
,170,170,170,170,233,167,159
,159,157,167,167,3031
32 2910 DATA170,93,247,255,127,
221,247,223,170,107,218,246,
118,253,253,246,3194
F6 2920 DATA159,157,159,165,177
,172,187,174,127,253,119,221
,117,84,3,254,2528
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44 2930 DATA246,214,90,222,123,46,250,174,170,93,247,255,127,221,247,223,2948
EC 2940 DATA247,217,217,217,217,217,217,218,247,217,217,217,217,217,105,105,3309
CE 2950 DATA218,246,189,253,253,221,252,240,167,159,157,159,159,79,63,255,3070
E5 2960 DATA85,154,154,153,86,153,106,84,85,154,85,105,105,150,0,0,1659
D6 2970 DATA85,154,154,90,149,102,169,21,104,104,104,84,104,104,104,104,1736
91 2980 DATA0,0,0,0,0,0,0,0,41,41,41,21,41,41,41,41,308
0C 2990 DATA84,104,104,104,104,84,104,104,0,0,0,0,0,0,0,0,792
B2 3000 DATA21,41,41,41,41,21,41,41,85,154,154,154,85,169,169,169,1427
1F 3010 DATA0,0,84,84,84,84,84,84,0,0,168,168,168,168,168,168,1512
61 3020 DATA0,20,86,170,170,171,255,255,0,81,89,170,174,255,255,255,2406
47 3030 DATA85,152,152,144,80,160,160,160,85,26,26,10,5,9,9,9,1272
D3 3040 DATA80,144,144,144,85,154,154,149,5,10,10,10,85,165,165,85,1589
42 3050 DATA170,175,190,170,174,234,170,174,170,170,186,171,170,234,175,190,2923
B7 3060 DATA170,166,175,189,159,167,165,170,170,170,90,254,221,246,86,90,2688
F6 3070 DATA234,154,175,191,170,165,250,170,170,111,170,249,170,190,170,90,2829
DF 3080 DATA0,0,252,252,252,252,252,252,106,166,190,170,105,154,190,175,2768
3D 3090 DATA169,250,166,190,170,246,90,175,21,148,145,20,145,132,17,68,2152
63 3100 DATA16,69,17,69,21,69,21,85,255,255,255,255,255,255,255,255,2407
E1 3110 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
D8 3120 DATA231,231,153,153,231,231,195,255,249,249,249,249,249,249,249,249,3672
D7 3130 DATA247,227,193,128,193,227,247,255,231,231,231,0,0,231,231,231,3103
CA 3140 DATA63,63,207,207,63,63,207,207,231,231,231,231,231,231,231,231,2928
49 3150 DATA255,255,252,193,137,201,201,255,0,128,192,224,240,248,252,254,3287
E6 3160 DATA255,255,255,255,255,255,255,255,15,15,15,15,15,15,15,15,2160
18 3170 DATA255,255,255,255,0,0,0,0,0,255,255,255,255,255,255,255,2805
08 3180 DATA255,255,255,255,255,255,255,0,63,63,63,63,63,63,63,63,2289
DD 3190 DATA51,51,204,204,51,51,204,204,252,252,252,252,252,252,252,252,3036
D7 3200 DATA255,255,255,255,51,51,204,204,0,1,3,7,15,31,63,127,1777
75 3210 DATA252,252,252,252,252,252,252,252,231,231,231,224,224,231,231,231,3850
86 3220 DATA255,255,255,255,240,240,240,240,231,231,231,224,224,255,255,255,3886
3E 3230 DATA255,255,255,7,7,231,231,231,255,255,255,255,255,255,0,0,3002
D7 3240 DATA255,255,255,224,224,231,231,231,231,231,231,0,0,255,255,255,3364
F8 3250 DATA255,255,255,0,0,231,231,231,231,231,231,7,7,231,231,231,2858
39 3260 DATA63,63,63,63,63,63,63,63,31,31,31,31,31,31,31,31,752
DA 3270 DATA248,248,248,248,248,248,248,248,0,0,255,255,255,255,255,255,3514
D5 3280 DATA0,0,255,255,255,255,255,255,255,255,255,255,0,0,0,0,2550
85 3290 DATA252,252,252,252,252,252,0,0,255,255,255,255,15,15,15,15,2592
8D 3300 DATA240,240,240,240,255,255,255,255,231,231,231,7,7,255,255,255,3452
22 3310 DATA15,15,15,15,255,255,255,255,15,15,15,15,240,240,240,240,2100
50 3320 DATA48,31,255,48,31,255,24,54,96,15,236,48,7,216,24,0,1388
```

PROGRAM: LOADER.3

```
85 10 REM****************
B9 20 REM*   LOADER.3   *
84 30 REM*  HOUR-GLASS  *
C7 40 REM****************
9B 2000 FORL=0TO45:CX=0:FORD=0TO15:READA:CX=CX+A:POKE8192+L*16+D,A:NEXTD
82 2010 READA:IFA<>CXTHENPRINT"ERROR IN LINE";2040+(L*10):STOP
0F 2020 NEXTL:END
02 2040 DATA224,239,224,248,251,251,253,253,0,255,0,0,255,255,255,255,3218
83 2050 DATA7,247,7,31,223,223,191,191,254,255,255,255,255,255,255,254,3158
BD 2060 DATA255,126,189,219,219,153,0,0,127,255,255,255,255,255,255,127,2945
5C 2070 DATA252,252,248,248,248,224,239,224,0,0,0,0,63,0,255,0,2253
FB 2080 DATA63,63,31,31,31,7,199,7,224,239,224,248,251,251,253,253,2375
A4 2090 DATA0,255,0,0,195,255,255,255,7,247,7,31,223,223,191,191,2335
71 2100 DATA254,255,255,255,255,255,255,254,255,126,189,219,219,153,0,24,3223
37 2110 DATA127,255,255,255,255,255,255,127,252,252,248,248,248,224,239,224,3719
D9 2120 DATA0,0,28,63,0,255,0,63,63,31,31,31,7,199,7,778
34 2130 DATA224,239,224,248,248,251,253,253,0,255,0,0,129,227,255,255,3061
0D 2140 DATA7,247,7,31,223,223,191,191,254,255,255,255,255,255,255,254,3158
01 2150 DATA255,126,189,219,219,153,0,24,127,255,255,255,255,255,255,127,2969
E7 2160 DATA252,252,248,248,248,224,239,224,0,0,16,124,255,0,255,0,2585
63 2170 DATA63,63,31,31,31,7,199,7,224,239,224,248,248,249,253,253,2370
B8 2180 DATA0,255,0,0,128,129,231,255,7,247,7,31,31,95,191,191,1798
BB 2190 DATA254,255,255,255,255,255,255,254,255,126,189,219,219,153,0,0,3199
3F 2200 DATA127,255,255,255,255,255,255,127,252,252,248,249,251,224,239,224,3723
2A 2210 DATA16,0,28,127,255,0,255,0,63,63,31,159,223,7,199,7,1433
D0 2220 DATA224,239,224,248,248,248,253,253,0,255,0,0,0,0,231,255,2678
A6 2230 DATA7,247,7,31,31,31,63,191,254,255,255,255,255,255,255,254,2646
31 2240 DATA255,126,189,219,219,137,16,8,127,255,255,255,255,255,255,127,2953
53 2250 DATA252,252,249,249,251,224,239,224,16,24,127,255,255,0,255,0,2872
F9 2260 DATA63,31,159,223,7,199,7,224,239,224,248,248,248,252,252,2687
6E 2270 DATA0,255,0,0,0,0,0,255,7,247,7,31,31,31,63,63,990
40 2280 DATA254,255,255,255,255,255,255,254,255,126,189,219,219,137,16,8,3207
33 2290 DATA127,255,255,255,255,255,255,127,252,252,251,251,251,224,239,224,3728
D1 2300 DATA16,126,255,255,255,0,255,0,63,63,159,159,223,7,199,7,2042
53 2310 DATA224,239,224,248,248,248,252,252,0,255,0,0,0,0,0,48,2238
7B 2320 DATA7,247,7,31,31,31,63,63,254,255,255,255,255,255,255,254,2518
5C 2330 DATA255,126,189,219,219,137,16,8,127,255,255,255,255,255,255,127,2953
0C 2340 DATA252,252,251,251,251,224,239,224,126,255,255,255,255,0,255,0,3345
32 2350 DATA63,63,223,223,223,7,199,7,224,239,224,248,248,248,252,252,2943
B8 2360 DATA0,255,0,0,0,0,0,0,7,247,7,31,31,31,63,63,735
ED 2370 DATA254,255,255,255,255,255,255,254,199,126,189,219,219,137,16,56,3199
FB 2380 DATA127,255,255,255,255,255,255,127,253,253,251,251,251,224,239,224,3730
D2 2390 DATA255,255,255,255,255
```

```
   ,0,255,0,191,191,223,223,223
   ,7,199,7,2794
4E 2400 DATA224,239,224,248,248
   ,248,252,252,0,255,0,0.0,0.0
   ,0.2190
A9 2410 DATA7,247.7,31.31,31.63
   ,63,254.255,255,255,255,255,
   255,254,2518
AE 2420 DATA0,70,189,219,219,13
   7,16,255,127,255,255,255,255
   ,255,255,127,2889
EA 2430 DATA253,253,251,251,251
   ,224,239,224,255,255,255,255
   ,255,0,255,0.3476
30 2440 DATA191,191,223,223,223
   ,7,199,7,224,239,224,248,248
   ,248,252,252,3199
76 2450 DATA0,255,0,0,0,0,0,0,7
   ,247,7,31,31,31,63,63.735
05 2460 DATA254,255,255,255,255
   ,255,255,254,0,0,129,195,195
   ,129,126,255,3067
41 2470 DATA127,255,255,255.255
   ,255,255,127,253,253.251,251
   ,251.224,239,224,3730
7E 2480 DATA255.255,255,255,255
   ,0,255,0,191,191,223,223.223
   ,7,247;7,2842
C7 2490 DATA195,207,207,207,207
   ,207,195,255.32,32,210,255,1
   69,92,32.210,2712
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PROGRAM: LOADER.4

```
AF 10 REM*********************
82 20 REM*    LOADER.4        *
23 30 REM OBJECT CODE PART 1 *
59 40 REM*********************
98 2000 FORL=0TO89:CX=0:FORD=0T
   O15:READA:CX=CX+A:POKE6144+L
   *16+D,A:NEXTD
82 2010 READA:IFA<>CXTHENPRINT"
   ERROR IN LINE";2040+(L*10):S
   TOP
0F 2020 NEXTL:END
CF 2040 DATA76,182,24,76,57,25,
   76,83,25.76,21,27,234,234,23
   4,8,1458
61 2050 DATA10,60.3,168,169,0,1
   33,251,133,252,192,0,240,25,
   192,10,1838
29 2060 DATA208.5.160,0,76,55,2
   4,24,165,251,105,72,133,251.
   165,252,1946
24 2070 DATA105.0,133,252.136,2
   08.240,24.105,32,133,252,160
   ,0,177,251,2208
46 2080 DATA153,64,42,200,192,7
   3,208,246.96,169.130,160,28,
   32,30,171,1994
70 2090 DATA169,8,141,172,2,169
   ,135,160,28,32,30,171,206,17
   2,2,208,1805
E3 2100 DATA244,169,164,160,28,
   32,30,171,169,27,141,105,4.9
   6,162,2,1704
7D 2110 DATA160,5,24,32,240,255
   ,173,178,2,32,140,24,96,162,
   7,160,1690
AC 2120 DATA5,24,32,240,255,173
   ,179,2.32,140,24,96,240,16,2
   01,1.1660
84 2130 DATA240,20,201,2,240,24
   ,169,89,160,29,32,30,171,96,
   169,231,1903
0D 2140 DATA160,28,32,30,171,96
   ,169,13,160,29,32,30,171,96,
   169,51,1437
B4 2150 DATA160,29,32,30,171,96
   ,169,3,141,134,2.169,147,32,
   210,255,1780
E0 2160 DATA169,0,141,33,208,16
   9,12,141,32,208,169.26,141,2
   4,208,32,1713
E1 2170 DATA245,24,32,73,24,32,
   110,24,32,125,24,162,5,160,3
   2,24,1128
AF 2180 DATA32,240,255,169,193,
   160,28,32,30,171,169,0,32,19
   ,24,169,1723
0F 2190 DATA27,141,6,6,96,162,1
   2,160,0,24,32,240,255,169,15
   3,160,1643
CB 2200 DATA27,32,30,171,169,10
   ,141,172,2,169,196,160,27,32
   ,30,171,1539
6F 2210 DATA206,172,2,208,244,1
   69,239,160,27,32,30,171,96,1
   62,18,160,2096
EB 2220 DATA0,24,32,240,255,169
   ,239,160,27,32,30,171,169,15
   3,160,27,1888
58 2230 DATA32,30,171,169,19,32
   ,210,255,96,162,20,160,0,24,
   32,240,1652
0D 2240 DATA255,169,3,141,172,2
   ,169,24,160,28,32,30,171,206
   ,172,2,1736
C3 2250 DATA208,244,96,162,12,1
   60,0,24,32,240,255,169,8,141
   ,172,2,1925
3B 2260 DATA169,24,160,28,32,30
   ,171,206,172,2,208,244,169,2
   7,141,6,1789
DB 2270 DATA6,96,169,32,141,104
   ,7,141,105,7,141,106,7,169,0
   ,141,1372
01 2280 DATA172,2,141,173,2,133
   ,162,169,255,141,175,2,32,22
   8,255,208,2250
BA 2290 DATA34,172,173,2,204,16
   ,24,208,3,76,149,26,165,162,
   205,17,1636
F1 2300 DATA24,208,233,238,173,
   2,169,0,133,162,173,173,2,32
   ,19,24,1765
56 2310 DATA76,140,25,201,13,24
   0,35,201,20,208,20,32,57,25,
   169,32,1494
2E 2320 DATA141,104,7,141,105,7
   ,141,106,7,32,127,29,76,140.
   25,201,1389
D8 2330 DATA47,144,185,201,58,1
   76,181;76,221,25,76,252,25,1
   41,167,2,1977
7F 2340 DATA173,105,7,141,104,7
   ,173,106,7,141,105.7,173,167
   ,2,141,1559
57 2350 DATA106,7.238,172,2,173
   ,172,2,201,3,208,144,169,255
   ,141,174,2167
59 2360 DATA2,173,106,7,201,32,
   240,72,56,233.48,141,174,2,1
   73,105,1765
A2 2370 DATA7,201,32,240,46,56,
   233,48,168,24,173,174,2,105,
   10,141,1660
8F 2380 DATA174,2,136,208,244,1
   73,104,7,201,32,240,23,233,4
   8,201,1,2027
F0 2390 DATA240,8,169,255,141,1
   74,2,76,80,26,24,173,174,2,1
   05,100,1749
05 2400 DATA141,174,2,173,174,2
   ,205,171,2,208,5,169,0,141,1
   75,2,1744
85 2410 DATA173,175,2,240,45,32
   ,57,25,162,20,160,5,24,32,24
   0,255,1647
07 2420 DATA169,67,160,28,32,30
   ,171,162,21,160,0,24,32,240,
   255,169,1720
45 2430 DATA130,160,27,32,30,17
   1,32,199,26,169,0,172,171,2,
   32,11,1364
A4 2440 DATA27,96,32,57,25,162,
   21,160,5,24,32,240,255,169,9
   8,160,1563
4F 2450 DATA28,32,30,171,96,169
   ,255,141,175,2,32,57,25,162,
   20,160,1555
95 2460 DATA5,24,32,240,255,169
   ,73,160,27,32,30,171,162,21,
   160,0,1561
94 2470 DATA24,32,240,255,169,1
   30,160,27,32,30,171,32,199,2
   6,169,0,1696
C2 2480 DATA172,171,2,32,11,27,
   96,162,21,160,23,24,32,240,2
   55,172,1600
DB 2490 DATA15,24,169,0,32,11,2
   7,169,32,32,210,255,169,92,3
   2,210,1479
64 2500 DATA255,172,169,2,169,0
   ,32,11,27,169,29,32,210,255,
   169,61,1762
04 2510 DATA32,210,255,96,169,2
   55,141,14,212,141,15,212,169
   ,128,141,18,2208
F9 2520 DATA212,141,24,212,173,
   27,212,141,168,2,96,32,145,1
   79,32,221,2017
FD 2530 DATA189,32,30,171,96,32
   ,244,26,205,18,24,176,248,24
   0,246,141,2118
03 2540 DATA169,2,32,244,26,201
   ,13,176,249,240,247,141,15,2
   4,160,0,1939
3C 2550 DATA140,171,2,173,171,2
   ,24,109,15,24,141,171,2,200,
   204,169,1718
2E 2560 DATA2,208,240,32,127,29
   ,76,114,25,5,83,79,82,82,89,
   32,1305
8D 2570 DATA89,79,85,32,72,65,8
   6,69,32,82,85,78,32,79,85,84
   ,1134
30 2580 DATA32,79,70,32,84,73,7
   7,69,0,5,87,72,65,84,32,73,9
   34
E1 2590 DATA83,32,84,72,69,32,6
   5,78,83,87,69,82,32,84,79,46
   ,1077
2E 2600 DATA46,0,29,5,32,32,32,
   32,32,84,72,69,32,65,78,83,7
   23
FB 2610 DATA87,69,82,32,73,83,4
   6,46,0,32,5,32,32,32,32,32,7
   15
6D 2620 DATA32,32,32,32,32,32,3
   2,32,32,32,32,32,32,32,32,32
   ,512
1B 2630 DATA32,32,32,32,32,32,3
   2,32,32,32,32,32,32,32,32,32
   ,512
6F 2640 DATA159,32,32,0,32,5,32
   ,32,32,32,32,32,32,32,32,32,
   580
CF 2650 DATA32,32,32,32,32,32,3
   2,32,32,32,32,32,32,32,32,32
   ,512
C7 2660 DATA32,32,32,32,32,32,3
   2,32,32,32,32,159,93,32,0,32
```

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     ,668
AA   2670 DATA159,95,33,33,33,33,
     33,33,33,33,33,33,33,33,33,3
     3,716
6C   2680 DATA33,33,33,33,33,33,3
     3,33,33,33,33,33,33,33,33,33
     ,528
2A   2690 DATA33,33,33,33,33,33,9
     4,0,29,5,32,32,32,32,32,32,5
     18
DD   2700 DATA32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,32
     ,512
CB   2710 DATA32,32,32,32,32,32,3
     2,32,32,32,32,32,32,32,32,15
     9,639
DE   2720 DATA93,29,0,5,32,32,83,
     79,82,82,89,32,84,72,65,84,9
     43
52   2730 DATA32,65,78,83,87,69,8
     2,32,73,83,32,87,82,79,78,71
     ,1113
0B   2740 DATA32,0,5,32,32,32,87,
     69,76,76,32,68,79,78,69,46,8
     13
DF   2750 DATA46,46,46,89,79,85,3
     2,65,82,69,32,82,73,71,72,84
     ,1053
A8   2760 DATA32,0,159,19,17,13,0
     ,29,29,29,29,29,29,29,29,29,
     501
E9   2770 DATA29,29,29,29,32,32,1
     46,64,64,64,64,64,64,64,64,6
     4,902
E5   2780 DATA64,93,13,0,29,29,29
     ,29,29,29,29,29,29,29,29,29,
     518
42   2790 DATA29,32,32,146,95,33,
     33,33,33,33,33,33,33,33,94,1
     3,738
48   2800 DATA0,5,200,201,202,159
     ,40,17,157,157,157,157,5,203
     ,204,205,2069
97   2810 DATA159,41,17,157,157,1
     57,157,5,206,207,208,159,41,
     17,157,157,2002
C8   2820 DATA157,157,45,43,43,42
     ,0,5,210,211,212,159,40,17,1
     57,157,1655
52   2830 DATA157,157,5,213,214,2
     15,159,41,17,157,157,157,157
     ,5,216,217,2244
34   2840 DATA218,159,41,17,157,1
     57,157,157,45,43,43,42,0,5,2
     19,220,1680
4A   2850 DATA221,159,40,17,157,1
     57,157,157,5,255,223,160,159
     ,41,17,157,2082
48   2860 DATA157,157,157,5,161,1
     62,163,159,41,17,157,157,157
     ,157,45,43,1895
F8   2870 DATA43,42,0,5,164,165,1
     66,159,40,17,157,157,157,157
     ,5,167,1601
79   2880 DATA168,169,159,41,17,1
     57,157,157,157,5,170,171,172
     ,159,41,17,1917
8B   2890 DATA157,157,157,157,45,
     43,43,42,0,5,173,174,175,159
     ,40,17,1544
98   2900 DATA157,157,157,157,5,1
     76,177,178,159,41,17,157,157
     ,157,157,5,2014
46   2910 DATA179,180,181,159,41,
     17,157,157,157,157,45,43,43,
     42,0,162,1720
97   2920 DATA21,160,2,24,32,240,
     255,169,105,160,27,32,30,171
     ,32,199,1659
E6   2930 DATA26,96,100,148,205,1
     36,136,136,202,136,136,136,2
     04,136,204,205,2342
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PROGRAM: LOADER.5

```
85   10 REM**********************
13   20 REM*       LOADER.5      *
12   30 REM* OBJECT CODE PART 2 *
73   40 REM**********************
F6   2000 FORL=0TO213:CX=0:FORD=0
     TO15:READA:CX=CX+A:POKE32768
     +L*16+D,A:NEXTD
82   2010 READA:IFA<>CXTHENPRINT"
     ERROR IN LINE";2040+(L*10):S
     TOP
0F   2020 NEXTL:END
D9   2040 DATA76,146,131,8,10,0,0
     ,172,188,2,169,0,133,251,169
     ,144,1599
BB   2050 DATA133,252,192,0,240,1
     6,24,165,251,105,80,133,251,
     165,252,105,2364
A7   2060 DATA0,133,252,136,208,2
     40,172,188,2,185,87,129,141,
     34,208,185,2300
B2   2070 DATA133,129,141,35,208,
     169,95,133,253,169,4,133,254
     ,169,95,133,2253
84   2080 DATA170,169,216,133,171
     ,173,3,128,141,6,128,169,54,
     133,1,160,1955
8B   2090 DATA0,177,251,145,253,1
     70,189,78,141,145,170,200,20
     4,4,128,208,2463
CE   2100 DATA240,206,6,128,240,4
     3,24,165,253,105,40,133,253,
     165,254,105,2360
13   2110 DATA0,133,254,24,165,17
     0,105,40,133,170,165,171,105
     ,0,133,171,1939
FF   2120 DATA24,165,251,109,4,12
     8,133,251,165,252,105,0,133,
     252,76,79,2127
B3   2130 DATA128,169,55,133,1,96
     ,169,26,141,24,208,173,22,20
     8,9,16,1578
40   2140 DATA141,22,208,160,0,14
     0,191,2,140,192,2,140,201,2,
     169,255,1965
9E   2150 DATA141,200,2,162,128,1
     85,1,129,157,78,141,200,232,
     224,214,208,2402
27   2160 DATA244,169,0,141,203,2
     ,141,206,2,141,205,2,141,207
     ,2,141,1947
B7   2170 DATA39,208,141,195,2,14
     1,196,2,141,197,2,141,198,2,
     160,0,1765
A5   2180 DATA169,1,153,224,134,2
     00,192,15,208,248,173,193,2,
     208,9,169,2298
37   2190 DATA30,141,219,137,141,
     221,137,96,169,52,141,221,13
     7,141,219,137,2339
4A   2200 DATA96,13,13,13,13,13,1
     3,13,13,13,13,15,15,15,15,15
     ,301
8F   2210 DATA15,15,15,15,15,15,1
     5,15,15,15,15,15,15,15,15,15
     ,240
A5   2220 DATA14,14,14,15,15,15,1
     5,15,13,13,14,14,14,14,13,13
     ,225
EE   2230 DATA13,13,13,13,13,15,1
     5,15,15,15,15,15,15,15,15,15
     ,230
8C   2240 DATA15,15,15,15,15,15,1
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     5,15,15,15,15,14,14,13,13,13
     ,232
97   2250 DATA13,13,13,13,13,13,1
     3,8,8,8,8,8,8,8,8,8,163
DA   2260 DATA8,8,8,8,8,8,8,8,8,8
     ,8,8,8,8,8,11,131
85   2270 DATA11,11,11,11,11,11,1
     1,11,11,11,8,8,8,8,8,8,158
0C   2280 DATA8,8,8,8,11,13,13,13
     ,13,13,13,13,13,13,13,13,186
D9   2290 DATA13,13,13,13,13,13,1
     3,13,13,13,13,13,13,12,12,12
     ,205
59   2300 DATA12,12,12,12,12,12,1
     2,12,13,13,13,13,13,13,13,13
     ,200
06   2310 DATA13,13,12,173,200,2,
     48,3,32,144,135,173,191,2,20
     1,8,1350
55   2320 DATA208,17,173,192,2,20
     1,11,208,10,173,201,2,201,4,
     208,3,1814
C9   2330 DATA169,2,96,173,193,2,
     240,6,32,229,137,76,227,129,
     32,228,1971
42   2340 DATA255,240,251,201,83,
     208,15,32,179,136,32,224,130
     ,32,179,136,2333
51   2350 DATA32,224,130,76,44,13
     0,201,78,208,15,32,204,136,3
     2,185,130,1857
53   2360 DATA32,204,136,32,185,1
     30,76,44,130,201,87,208,15,3
     2,254,136,1902
50   2370 DATA32,7,131,32,254,136
     ,32,7,131,76,44,130,201,69,2
     08,12,1502
F8   2380 DATA32,229,136,32,56,13
     1,32,229,136,32,56,131,173,0
     ,208,201,1814
6D   2390 DATA142,240,76,201,204,
     240,101,173,1,208,201,66,240
     ,7,201,109,2410
F4   2400 DATA240,32,76,179,129,3
     2,53,141,206,192,2,32,128,13
     5,32,91,1700
99   2410 DATA137,185,110,137,141
     ,188,2,32,7,128,169,107,141,
     1,208,76,1769
65   2420 DATA107,135,32,53,141,2
     38,192,2,32,128,135,32,91,13
     7,185,110,1750
98   2430 DATA137,141,188,2,32,7,
     128,169,68,141,1,208,76,107,
     135,32,1572
17   2440 DATA53,141,206,191,2,32
     ,128,135,32,91,137,185,110,1
     37,141,188,1909
59   2450 DATA2,32,7,128,169,200,
     141,0,208,76,107,135,32,53,1
     41,238,1669
E7   2460 DATA191,2,32,128,135,32
     ,91,137,185,110,137,141,188,
     2,32,7,1550
31   2470 DATA128,169,144,141,0,2
     08,76,107,135,173,0,208,141,
     189,2,173,1994
38   2480 DATA1,208,141,190,2,206
     ,190,2,32,23,137,160,0,177,1
     80,32,1681
D7   2490 DATA108,131,240,11,200,
     177,180,32,108,131,240,3,206
     ,1,208,96,2072
81   2500 DATA173,0,208,141,189,2
     ,173,1,208,24,105,21,141,190
     ,2,32,1610
D0   2510 DATA23,137,160,0,177,18
     0,32,108,131,240,11,200,177,
     180,32,108,1896
74   2520 DATA131,240,3,238,1,208
     ,96,173,1,208,141,190,2,173,
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   0,208,2013
97 2530 DATA141,189,2,238,189,2
   ,32,23,137,160,0,177,180,32,
   108,131,1741
BF 2540 DATA240,21,160,40,177,1
   80,32,108,131,240,12,160,80,
   177,180,32,1970
E2 2550 DATA108,131,240,3,206,0
   ,208,96,173,1,208,141,190,2,
   173,0,1880
42 2560 DATA208,24,105,19,141,1
   89,2,238,189,2,32,23,137,160
   ,0,177,1646
6D 2570 DATA180,32,108,131,240,
   21,160,40,177,180,32,108,131
   ,240,12,160,1952
06 2580 DATA80,177,180,32,108,1
   31,240,3,238,0,208,96,201,13
   7,240,31,2102
9A 2590 DATA201,136,240,27,201,
   162,240,23,201,167,240,19,20
   1,168,240,15,2481
CB 2600 DATA201,163,240,11,201,
   146,240,7,201,147,240,3,169,
   0,96,169,2234
19 2610 DATA255,96,32,39,132,32
   ,150,128,169,128,141,138,2,3
   2,0,24,1498
9D 2620 DATA162,1,160,30,24,32,
   240,255,169,168,160,139,32,3
   0,171,32,1805
80 2630 DATA91,137,185,110,137,
   141,188,2,32,7,128,169,192,1
   41,248,7,1915
D7 2640 DATA169,170,141,0,208,1
   69,90,141,1,208,173,21,208,9
   ,1,141,1850
3B 2650 DATA21,208,32,179,129,2
   01,2,208,15,160,3,162,13,24,
   32,240,1629
52 2660 DATA255,169,44,160,140,
   32,30,171,160,6,162,16,24,32
   ,240,255,1896
85 2670 DATA169,115,160,140,32,
   30,171,172,207,2,32,66,141,1
   69,129,160,1895
6E 2680 DATA140,32,30,171,160,3
   ,162,18,24,32,240,255,169,13
   9,160,140,1875
61 2690 DATA32,30,171,172,205,2
   ,32,66,141,169,148,160,140,3
   2,30,171,1701
32 2700 DATA172,206,2,32,66,141
   ,96,169,0,141,32,208,141,33,
   208,169,1816
96 2710 DATA147,32,210,255,162,
   5,160,7,24,32,240,255,169,40
   ,160,138,2036
95 2720 DATA32,30,171,162,7,160
   ,8,24,32,240,255,169,67,160,
   138,32,1687
FE 2730 DATA30,171,162,9,160,7,
   24,32,240,255,169,93,160,138
   ,32,30,1712
9E 2740 DATA171,162,20,160,9,24
   ,32,240,255,169,121,160,138,
   32,30,171,1894
ED 2750 DATA32,228,255,208,19,1
   60,0,238,194,2,173,194,2,153
   ,218,216,2292
44 2760 DATA200,192,14,208,248,
   76,112,132,169,145,160,138,3
   2,30,171,32,2059
AE 2770 DATA228,255,240,251,201
   ,49,144,247,201,54,176,243,5
   6,233,48,168,2794
73 2780 DATA136,185,46,135,141,
   18,24,185,62,135,141,17,24,1
   41,199,2,1591
9C 2790 DATA169,182,160,138,32,
   30,171,162,3,160,13,24,32,24
   0,255,169,1940
5D 2800 DATA211,160,138,32,30,1
   71,162,4,160,13,24,32,240,25
   5,169,221,2022
F2 2810 DATA160,138,32,30,171,1
   62,5,160,13,24,32,240,255,16
   9,231,160,1982
F2 2820 DATA138,32,30,171,162,6
   ,160,13,24,32,240,255,169,24
   4,160,138,1974
67 2830 DATA32,30,171,162,14,16
   0,14,24,32,240,255,169,0,160
   ,139,32,1634
E3 2840 DATA30,171,32,228,255,2
   40,251,201,49,144,247,201,53
   ,176,243,32,2553
01 2850 DATA210,255,56,233,49,1
   41,178,2,162,15,160,14,24,32
   ,240,255,2026
7A 2860 DATA169,13,160,139,32,3
   0,171,32,228,255,240,251,201
   ,49,144,247,2361
97 2870 DATA201,53,176,243,141,
   194,2,56,233,49,205,178,2,24
   0,232,141,2346
D7 2880 DATA179,2,173,194,2,32,
   210,255,169,26,160,139,32,30
   ,171,32,1806
B1 2890 DATA228,255,240,251,201
   ,74,240,12,201,75,208,243,16
   9,0,141,193,2731
5C 2900 DATA2,76,105,133,169,1,
   141,193,2,169,147,32,210,255
   ,162,12,1809
8F 2910 DATA160,6,24,32,240,255
   ,169,94,160,139,32,30,171,16
   9,4,32,1717
A2 2920 DATA31,141,96,173,200,2
   ,168,24,105,212,141,249,7,18
   5,235,133,2102
23 2930 DATA141,37,208,185,250,
   133,141,40,208,185,9,134,141
   ,38,208,185,2243
EB 2940 DATA209,134,141,28,208,
   185,239,134,141,23,208,185,2
   54,134,141,29,2393
51 2950 DATA208,185,13,135,141,
   2,208,185,30,135,141,3,208,1
   73,21,208,1996
A4 2960 DATA9,2,141,21,208,140,
   194,2,162,13,160,3,24,32,240
   ,255,1606
9D 2970 DATA169,123,160,139,32,
   30,171,174,194,2,224,11,144,
   2,162,11,1748
CC 2980 DATA189,36,134,168,189,
   24,134,32,30,171,96,2,4,7,14
   ,14,1244
36 2990 DATA12,12,12,6,8,8,0,0,
   0,0,2,6,2,6,1,11,86
FB 3000 DATA9,9,10,10,10,0,0,0,
   0,7,1,1,1,1,1,1,61
D9 3010 DATA8,9,9,9,0,0,0,0,48,
   58,65,80,88,103,115,125,717
EC 3020 DATA134,143,151,160,134
   ,134,134,134,134,134,134,134
   ,134,134,134,134,2196
CB 3030 DATA65,32,80,72,79,69,7
   8,73,88,0,65,32,66,76,79,66,
   1020
DC 3040 DATA0,69,78,67,72,65,78
   ,84,69,68,32,70,73,82,69,0,9
   76
38 3050 DATA65,32,83,78,65,75,6
   9,0,65,32,77,89,83,84,73,67,
   1037
F8 3060 DATA32,67,76,79,85,68,0
   ,65,32,87,72,73,82,76,87,73,
   1054
44 3070 DATA78,68,0,65,32,83,79
   ,76,68,73,69,82,0,65,78,32,9
   48
30 3080 DATA69,65,71,76,69,0,65
   ,32,87,73,90,65,82,68,0,65,9
   77
87 3090 DATA32,71,78,79,77,69,0
   ,65,32,90,79,77,66,73,69,0,9
   57
21 3100 DATA65,32,80,73,69,67,6
   9,32,79,70,32,84,72,69,32,75
   ,1000
51 3110 DATA69,89,0,6,4,8,3,3,1
   ,2,4,0,6,0,0,3,198
24 3120 DATA8,0,11,4,9,5,8,11,0
   ,11,2,2,10,3,7,8,99
BC 3130 DATA11,0,2,2,2,0,2,2,0,
   2,2,2,0,0,0,0,27
1A 3140 DATA1,1,1,1,1,1,1,1,1,1
   ,1,1,1,1,1,2,17
04 3150 DATA0,2,2,2,2,2,0,2,0,2
   ,0,0,0,0,0,0,14
30 3160 DATA2,0,2,2,0,0,0,0,0,0
   ,0,0,0,170,170,164,510
F1 3170 DATA172,160,160,170,170
   ,170,170,170,170,170,170,170
   ,170,170,80,88,2530
79 3180 DATA80,84,80,80,80,80,8
   0,80,80,80,90,84,84,84,3,6,1
   155
BB 3190 DATA8,10,13,5,3,3,3,3,3
   ,3,3,5,3,3,60,54,182
AA 3200 DATA48,42,36,160,255,14
   0,200,2,185,179,134,205,191,
   2,208,11,1998
B1 3210 DATA185,194,134,205,192
   ,2,208,3,76,97,135,200,192,1
   5,208,232,2278
14 3220 DATA96,170,185,224,134,
   240,3,140,200,2,96,169,1,141
   ,21,208,2030
08 3230 DATA32,67,135,173,200,2
   ,201,255,240,3,32,131,133,76
   ,179,129,1988
89 3240 DATA162,13,160,3,24,32,
   240,255,169,133,160,139,32,3
   0,171,96,1819
88 3250 DATA173,200,2,201,11,14
   4,58,238,201,2,168,169,0,153
   ,224,134,2078
00 3260 DATA173,201,2,24,105,48
   ,141,117,4,169,2,32,31,141,3
   2,128,1350
A9 3270 DATA135,32,212,140,169,
   255,141,200,2,162,13,160,3,2
   4,32,240,1920
2B 3280 DATA255,169,199,160,139
   ,32,30,171,169,3,32,31,141,3
   2,128,135,1826
10 3290 DATA96,162,14,160,3,24,
   32,240,255,169,234,160,139,3
   2,30,171,1921
76 3300 DATA172,200,2,185,51,13
   5,141,202,2,24,105,48,32,210
   ,255,169,1933
64 3310 DATA31,160,140,32,30,17
   1,169,0,141,203,2,141,204,2,
   173,202,1801
E3 3320 DATA2,24,109,206,2,141,
   206,2,32,3,24,32,9,24,173,17
   5,1164
FB 3330 DATA2,240,6,238,204,2,7
   6,28,136,238,203,2,169,2,32,
   31,1609
48 3340 DATA141,206,202,2,208,2
   26,173,205,2,24,109,203,2,14
   1,205,2,2051
C6 3350 DATA173,203,2,205,204,2
   ,144,49,32,212,140,238,207,2
   ,172,200,2185
70 3360 DATA2,169,0,153,224,134
   ,169,255,141,200,2,32,3,24,3
   2,6,1546
30 3370 DATA24,162,13,160,10,24
```

```
    ,32,240,255,169,167,160,140,
    32,30,171,1789
AC  3380 DATA169,3,32,31,141,32,
    6,24,96,32,3,24,32,6,24,173,
    828
BF  3390 DATA208,2,141,191,2,173
    ,209,2,141,192,2,32,91,137,1
    85,110,1818
20  3400 DATA137,141,188,2,32,7,
    128,169,1,141,21,208,169,170
    ,141,0,1655
07  3410 DATA208,169,90,141,1,20
    8,169,255,141,200,2,162,13,1
    60,10,24,1953
8C  3420 DATA32,240,255,169,189,
    160,140,32,30,171,169,3,32,3
    1,141,32,1826
49  3430 DATA6,24,96,238,195,2,1
    72,195,2,192,5,208,5,160,0,1
    40,1640
3A  3440 DATA195,2,185,20,138,14
    1,248,7,32,218,137,96,238,19
    7,2,172,2028
DD  3450 DATA197,2,192,5,208,5,1
    60,0,140,197,2,185,25,138,14
    1,248,1845
94  3460 DATA7,32,218,137,96,238
    ,196,2,172,196,2,192,5,208,5
    ,160,1866
F4  3470 DATA0,140,196,2,185,30,
    138,141,248,7,32,218,137,96,
    238,198,2006
B3  3480 DATA2,172,198,2,192,5,2
    08,5,160,0,140,198,2,185,35,
    138,1642
F9  3490 DATA141,248,7,32,218,13
    7,96,173,189,2,56,233,24,74,
    74,74,1778
F4  3500 DATA141,189,2,173,190,2
    ,56,233,50,74,74,74,141,190,
    2,169,1760
E7  3510 DATA0,133,180,169,4,133
    ,181,172,190,2,240,16,24,165
    ,180,105,1894
5D  3520 DATA40,133,180,165,181,
    105,0,133,181,136,208,240,24
    ,165,180,109,2180
F4  3530 DATA189,2,133,180,165,1
    81,105,0,133,181,96,169,0,17
    2,192,2,1900
B7  3540 DATA240,6,24,105,9,136,
    208,250,24,109,191,2,168,96,
    0,1,1569
3C  3550 DATA8,8,8,5,6,8,5,3,4,2
    ,10,11,9,10,11,19,127
FB  3560 DATA6,8,8,11,19,14,18,2
    1,19,12,17,21,15,17,20,20,24
    6
91  3570 DATA21,19,37,38,38,38,3
    5,38,38,38,36,39,40,40,40,41
    ,576
AE  3580 DATA40,40,40,42,17,18,2
    1,18,21,18,21,18,19,17,16,15
    ,381
BE  3590 DATA0,13,22,21,16,15,10
    ,8,4,7,21,43,44,24,24,10,282

95  3600 DATA11,4,8,21,20,21,32,
    27,17,21,16,21,32,32,32,27,3
    42
FB  3610 DATA34,14,29,28,29,29,2
    9,45,33,34,162,150,160,150,1
    36,208,1270
9F  3620 DATA253,202,208,248,96,
    173,0,220,41,15,141,194,2,56
    ,169,15,2033
21  3630 DATA237,194,2,240,240,2
    01,1,208,3,169,78,96,201,2,2
    08,3,2083
3D  3640 DATA169,83,96,201,4,208
    ,3,169,87,96,201,8,208,3,169
    ,69,1774
CB  3650 DATA96,76,229,137,194,1
    95,196,192,193,199,200,201,1
    97,198,204,205,2912
9D  3660 DATA206,202,203,209,210
    ,211,207,208,5,87,69,76,67,7
    9,77,69,2185
6C  3670 DATA32,84,79,32,65,67,7
    5,82,79,89,68,39,83,32,83,65
    ,1054
66  3680 DATA71,65,0,158,65,78,3
    2,69,68,85,67,65,84,73,79,78
    ,1137
06  3690 DATA65,76,32,65,68,86,6
    9,78,84,85,82,69,0,155,66,89
    ,1169
BC  3700 DATA32,65,76,76,69,78,3
    2,65,78,68,32,77,65,82,71,65
    ,1031
06  3710 DATA82,69,84,32,87,69,6
    6,66,0,5,80,82,69,83,83,32,9
    89
B3  3720 DATA65,78,89,32,75,69,8
    9,32,84,79,32,83,84,65,82,84
    ,1122
E4  3730 DATA0,147,5,67,72,79,79
    ,83,69,32,68,73,70,70,73,67,
    1054
CD  3740 DATA85,76,84,89,32,40,4
    9,61,69,65,83,89,32,32,53,61
    ,1000
CE  3750 DATA72,65,82,68,41,0,14
    7,5,80,76,69,65,83,69,32,67,
    1021
C4  3760 DATA72,79,79,83,69,32,8
    9,79,85,82,32,87,69,65,80,79
    ,1161
20  3770 DATA78,83,0,49,46,32,32
    ,32,32,65,88,69,0,50,46,32,7
    34
9F  3780 DATA32,32,32,66,79,87,0
    ,51,46,32,32,32,32,83,72,73,
    781
49  3790 DATA69,76,68,0,52,46,32
    ,32,32,32,83,87,79,82,68,0,8
    38
30  3800 DATA158,87,69,65,80,79,
    78,32,49,63,5,32,0,158,87,69
    ,1111
8D  3810 DATA65,80,79,78,32,50,6
    3,5,32,0,147,5,80,76,69,65,9
    26
66  3820 DATA83,69,32,67,72,79,7
    9,83,69,32,67,79,78,84,82,79
    ,1134
52  3830 DATA76,32,77,69,84,72,7
    9,68,58,13,18,158,75,146,46,
    46,1117
0C  3840 DATA46,46,5,75,69,89,66
    ,79,65,82,68,13,18,158,74,14
    6,1099
B3  3850 DATA46,46,46,46,5,74,79
    ,89,83,84,73,67,75,0,5,71,88
    9
67  3860 DATA79,79,68,32,76,85,6
    7,75,32,65,78,68,32,72,65,80
    ,1053
7C  3870 DATA80,89,32,72,85,78,8
    4,73,78,71,0,5,89,79,85,32,1
    032
D3  3880 DATA83,69,69,32,0,5,32,
    32,32,32,32,32,32,32,32,32,5
    78
F8  3890 DATA32,32,32,32,32,32,3
    2,32,32,32,32,32,32,32,32,32
    ,512
24  3900 DATA32,32,32,32,32,32,3
    2,0,159,75,69,89,32,80,65,82
    ,875
C9  3910 DATA84,83,32,17,157,157
    ,157,157,157,157,157,157,157
    ,157,70,79,1935
80  3920 DATA85,78,68,58,32,48,0
    ,5,87,73,84,72,32,65,32,70,8
    89
50  3930 DATA76,65,83,72,32,79,7
    0,32,76,73,71,72,84,32,73,84
    ,1074
98  3940 DATA32,86,65,78,73,83,7
    2,69,83,0,5,79,72,32,68,69,9
    66
3A  3950 DATA65,82,32,32,89,79,8
    5,32,87,73,76,76,32,72,65,86
    ,1063
D1  3960 DATA69,32,84,79,32,70,7
    3,71,72,84,13,29,29,29,89,79
    ,934
A3  3970 DATA85,32,77,85,83,84,3
    2,65,78,83,87,69,82,32,0,32,
    1006
F4  3980 DATA83,85,77,83,32,84,7
    9,32,87,73,78,0,5,84,72,69,1
    023
31  3990 DATA32,75,69,89,32,80,6
    5,82,84,83,32,77,65,71,73,67
    ,1076
14  4000 DATA65,76,76,89,32,74,7
    9,73,78,46,32,89,79,85,13,29
    ,1015
D2  4010 DATA29,29,29,32,65,82,6
    9,32,82,69,65,68,89,32,84,79
    ,935
E8  4020 DATA32,69,78,84,69,82,3
    2,84,72,69,32,67,65,83,84,76
    ,1078
C4  4030 DATA69,13,0,29,29,29,89
    ,79,85,32,75,73,76,76,69,68,
    891
C1  4040 DATA0,32,78,65,83,84,73
    ,69,83,13,0,29,65,78,68,32,8
    52
00  4050 DATA71,79,84,0,32,83,85
    ,77,83,32,82,73,71,72,84,32,
    1040
2B  4060 DATA79,85,84,32,79,70,0
    ,5,87,69,76,76,32,68,79,78,9
    99
67  4070 DATA69,46,46,46,46,89,7
    9,85,32,87,79,78,0,5,66,69,9
    22
14  4080 DATA84,84,69,82,32,76,8
    5,67,75,32,78,69,88,84,32,84
    ,1121
02  4090 DATA73,77,69,0,169,230,
    141,249,7,173,2,208,56,233,8
    ,141,1836
AC  4100 DATA2,208,173,3,208,56,
    233,4,141,3,208,169,2,141,29
    ,208,1788
49  4110 DATA141,23,208,169,0,14
    1,28,208,32,17,141,173,249,7
    ,201,227,1965
74  4120 DATA240,6,206,249,7,76,
    248,140,173,21,208,41,253,14
    1,21,208,2238
F1  4130 DATA96,162,150,160,150,
    136,208,253,238,40,208,202,2
    08,245,96,141,2693
85  4140 DATA194,2,169,0,133,162
    ,165,162,201,60,208,250,206,
    194,2,240,2348
5D  4150 DATA3,76,34,141,96,173,
    191,2,141,208,2,173,192,2,14
    1,209,1784
7B  4160 DATA2,96,169,0,32,145,1
    79,32,221,189,32,30,171,96,0
    ,136,1530
5A  4170 DATA137,206,136,136,136
    ,137,136,137,137,136,137,137
    ,204,205,136,136,2389
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PROGRAM: LOADER.6

```
85  10 REM************
BC  20 REM* LOADER.6 *
D3  30 REM*   MAP    *
BF  40 REM************
56  2000 FORL=0TO230:CX=0:FORD=0
    TO15:READA:CX=CX+A:POKE36864
    +L*16+D,A:NEXTD
82  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
E7  2040 DATA148,128,129,130,136
    ,134,135,136,128,129,137,131
    ,132,133,136,136,2138
0E  2050 DATA137,137,131,132,137
    ,134,135,137,136,137,204,205
    ,134,135,137,136,2304
D3  2060 DATA137,137,136,137,136
    ,137,137,137,204,205,137,136
    ,137,136,137,173,2359
2A  2070 DATA179,175,179,175,136
    ,136,137,136,137,176,177,178
    ,177,178,136,136,2548
A4  2080 DATA137,137,136,136,137
    ,204,136,204,205,137,137,136
    ,136,128,129,130,2365
23  2090 DATA136,136,131,132,133
    ,178,136,204,205,136,130,137
    ,134,135,136,136,2335
57  2100 DATA136,136,173,179,133
    ,136,136,137,137,137,136,136
    ,176,177,136,204,2405
3E  2110 DATA205,136,137,136,137
    ,137,137,136,136,136,137,137
    ,136,136,136,137,2252
9A  2120 DATA136,136,128,129,130
    ,136,136,137,136,136,136,136
    ,131,132,133,136,2144
64  2130 DATA136,173,179,175,136
    ,128,134,135,136,204,205,176
    ,177,178,136,131,2539
27  2140 DATA173,179,175,136,136
    ,136,136,128,129,130,176,177
    ,178,137,137,137,2400
38  2150 DATA136,131,132,133,136
    ,136,136,136,136,136,136,134
    ,135,136,136,136,2161
34  2160 DATA137,136,136,136,137
    ,137,136,136,136,137,137,137
    ,137,136,204,205,2320
D5  2170 DATA204,205,136,136,136
    ,136,136,136,137,204,205,136
    ,175,204,205,128,2619
0E  2180 DATA129,130,136,136,173
    ,179,178,136,136,131,132,133
    ,137,136,176,177,2355
79  2190 DATA204,205,136,204,137
    ,137,136,137,176,177,136,204
    ,205,136,137,137,2604
69  2200 DATA137,136,137,204,173
    ,175,136,136,136,137,137,137
    ,136,137,176,178,2408
7D  2210 DATA204,205,137,136,137
    ,137,137,137,204,205,136,204
    ,205,137,136,136,2593
9A  2220 DATA137,137,137,137,204
    ,205,137,128,129,130,204,205
    ,137,202,203,203,2635
13  2230 DATA202,131,132,133,137
    ,173,202,202,203,202,137,134
    ,135,136,137,176,2572
BB  2240 DATA175,134,135,137,136
    ,176,177,178,136,137,178,137
    ,136,204,205,136,2517
64  2250 DATA136,136,204,205,137
    ,136,136,137,137,137,136,136
    ,137,137,137,137,2321
BE  2260 DATA137,137,136,136,136
    ,137,136,137,137,136,136,137
    ,137,136,136,137,2184
8C  2270 DATA137,137,179,175,137
    ,128,129,130,137,136,136,137
    ,177,178,136,131,2320
B9  2280 DATA132,133,204,205,136
    ,137,136,137,137,134,135,136
    ,137,128,129,130,2286
ED  2290 DATA136,136,137,131,132
    ,133,128,129,130,136,173,179
    ,175,134,135,136,2260
25  2300 DATA131,132,133,136,176
    ,177,178,136,137,137,134,135
    ,136,136,136,136,2286
35  2310 DATA136,136,136,204,205
    ,136,204,205,136,137,137,137
    ,136,136,137,137,2455
70  2320 DATA136,128,136,136,136
    ,136,136,136,204,205,136,131
    ,136,137,137,137,2303
75  2330 DATA136,136,136,137,137
    ,134,204,205,136,136,137,137
    ,137,173,179,175,2435
A0  2340 DATA205,136,136,137,137
    ,131,132,133,137,137,136,173
    ,179,175,136,134,2354
32  2350 DATA135,136,204,205,137
    ,176,177,178,137,136,136,137
    ,137,137,137,137,2442
CB  2360 DATA136,136,136,137,137
    ,136,136,137,173,175,137,137
    ,136,136,137,137,2259
42  2370 DATA136,137,176,178,136
    ,136,137,137,137,136,137,137
    ,136,137,137,137,2267
84  2380 DATA136,136,173,179,175
    ,136,204,205,137,136,136,136
    ,176,177,178,205,2625
46  2390 DATA131,132,133,137,136
    ,136,137,137,173,175,134,135
    ,204,205,137,137,2379
58  2400 DATA137,136,176,178,137
    ,137,136,136,136,136,137,136
    ,137,137,136,136,2264
65  2410 DATA137,137,137,137,137
    ,136,136,137,137,137,137,137
    ,136,136,136,137,2187
A2  2420 DATA137,137,137,136,136
    ,136,137,136,137,128,129,130
    ,137,173,179,175,2280
22  2430 DATA204,205,137,131,132
    ,133,137,176,177,178,137,136
    ,136,134,135,137,2425
C2  2440 DATA134,135,136,173,179
    ,175,136,137,131,132,136,136
    ,136,176,177,178,2407
78  2450 DATA204,205,134,135,136
    ,136,137,137,137,136,136,136
    ,136,137,136,136,2314
BB  2460 DATA137,137,137,137,136
    ,136,136,136,136,136,136,136
    ,136,136,137,137,2182
13  2470 DATA136,137,136,137,137
    ,137,137,137,136,136,136,137
    ,137,204,205,136,2321
BF  2480 DATA137,136,136,202,203
    ,203,205,137,137,137,137,136
    ,137,137,203,202,2585
FB  2490 DATA173,179,175,136,136
    ,136,137,137,173,179,176,177
    ,178,137,136,136,2501
F6  2500 DATA136,136,176,177,136
    ,137,204,205,136,137,137,136
    ,137,136,136,136,2398
F0  2510 DATA136,137,137,136,136
    ,128,129,130,136,137,137,137
    ,137,136,137,131,2157
67  2520 DATA132,133,136,136,136
    ,136,136,136,136,134,135,136
    ,179,175,137,137,2250
5E  2530 DATA136,137,137,137,128
    ,129,177,178,136,136,137,137
    ,136,136,131,132,2240
85  2540 DATA131,132,133,137,136
    ,137,137,137,202,203,134,135
    ,136,136,136,137,2299
99  2550 DATA136,202,203,204,128
    ,129,130,136,136,136,137,136
    ,136,136,131,132,2348
7B  2560 DATA133,136,136,137,136
    ,137,136,136,134,135,137,137
    ,136,136,136,136,2174
F5  2570 DATA136,136,136,204,205
    ,136,136,136,136,137,137,136
    ,179,175,137,137,2399
AE  2580 DATA137,136,204,205,204
    ,205,177,178,136,136,137,137
    ,137,173,179,175,2656
C9  2590 DATA131,132,133,137,136
    ,136,136,137,173,179,134,135
    ,136,136,137,137,2245
03  2600 DATA137,136,176,177,137
    ,137,136,137,137,137,136,136
    ,137,137,136,137,2266
4A  2610 DATA137,137,136,137,137
    ,137,137,137,137,136,137,137
    ,136,137,137,137,2189
4C  2620 DATA136,137,137,136,137
    ,137,136,136,136,137,137,137
    ,204,205,204,205,2457
4A  2630 DATA137,137,136,136,128
    ,129,137,204,205,136,136,137
    ,137,137,131,132,2295
46  2640 DATA209,210,207,136,136
    ,136,136,207,207,209,207,137
    ,137,137,137,136,2684
F4  2650 DATA137,136,136,210,136
    ,136,136,136,136,136,136,136
    ,136,206,207,136,2392
76  2660 DATA136,136,137,137,137
    ,136,136,137,207,207,136,136
    ,136,136,136,210,2396
AF  2670 DATA209,206,209,210,206
    ,137,136,136,136,137,137,209
    ,204,205,136,204,2817
D8  2680 DATA205,137,137,204,205
    ,136,136,204,205,136,204,205
    ,136,136,136,136,2658
02  2690 DATA202,202,203,137,136
    ,137,137,206,207,137,203,203
    ,136,136,137,137,2656
E7  2700 DATA136,136,137,209,202
    ,203,137,136,137,136,136,136
    ,136,210,137,203,2527
F4  2710 DATA202,137,136,136,136
    ,137,137,207,202,137,136,137
    ,137,137,136,136,2386
4A  2720 DATA136,206,203,136,136
    ,136,136,137,137,137,137,137
    ,203,202,137,137,2453
28  2730 DATA136,136,136,136,210
    ,207,203,137,202,137,137,137
    ,137,209,136,137,2533
8A  2740 DATA176,177,178,137,136
    ,136,136,136,173,179,206,207
    ,136,136,136,137,2522
6A  2750 DATA137,137,176,177,209
    ,210,136,137,137,137,136,136
    ,136,137,207,136,2481
44  2760 DATA136,136,136,136,136
    ,137,136,136,136,209,136,136
    ,137,137,136,136,2252
F7  2770 DATA136,136,136,137,137
    ,137,136,136,137,136,137,136
    ,204,205,136,137,2319
B3  2780 DATA136,136,137,137,207
    ,206,204,137,204,137,207,209
    ,204,136,136,136,2669
20  2790 DATA206,209,137,136,136
    ,137,136,202,203,202,210,136
    ,136,137,137,137,2597
59  2800 DATA136,136,203,203,136
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   ,136,136,136,136,136,136,203
   ,202,203,136,136,2510
C1 2810 DATA137,136,136,137,136
   ,136,136,203,136,136,136,136
   ,136,136,202,137,2312
38 2820 DATA203,136,202,137,137
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   ,136,203,136,136,2579
8E 2830 DATA136,136,202,137,137
   ,136,136,136,136,203,202,137
   ,136,136,136,136,2378
F6 2840 DATA137,137,136,136,128
   ,129,130,137,207,206,204,205
   ,136,137,131,132,2428
4B 2850 DATA133,209,210,137,137
   ,137,136,137,134,135,136,136
   ,136,207,137,137,2394
07 2860 DATA137,137,136,137,136
   ,137,137,137,137,136,137,137
   ,136,137,136,136,2186
17 2870 DATA137,137,209,136,136
   ,137,137,136,136,137,137,137
   ,207,210,137,137,2403
EE 2880 DATA136,137,137,136,207
   ,206,207,209,206,136,207,209
   ,210,209,209,137,2898
45 2890 DATA202,137,202,136,136
   ,136,137,204,205,136,203,202
   ,136,136,137,136,2581
C5 2900 DATA136,137,204,205,136
   ,202,203,137,137,137,136,136
   ,137,136,136,136,2451
14 2910 DATA202,136,136,136,136
   ,136,137,136,136,203,136,136
   ,136,137,136,136,2311
C1 2920 DATA137,136,136,202,136
   ,136,136,137,137,137,137,204
   ,136,203,137,137,2384
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   ,136,136,136,202,136,136,136
   ,204,136,204,205,2586
D9 2940 DATA206,209,207,137,136
   ,136,137,207,206,209,210,207
   ,136,136,137,137,2753
FE 2950 DATA136,137,137,210,136
   ,136,136,137,137,137,136,136
   ,137,137,137,136,2258
A3 2960 DATA137,136,136,137,137
   ,137,137,137,137,137,137,137
   ,136,137,137,136,2188
3C 2970 DATA137,137,207,136,137
   ,136,204,205,136,136,137,207
   ,207,207,137,137,2603
0D 2980 DATA173,179,175,137,207
   ,207,137,137,204,205,176,177
   ,178,137,204,205,2838
B2 2990 DATA207,206,210,137,137
   ,137,137,137,207,137,209,137
   ,137,137,137,137,2546
BE 3000 DATA137,137,137,207,137
   ,137,137,137,137,137,137,137
   ,137,207,137,137,2332
35 3010 DATA137,137,137,137,173
   ,175,137,137,137,137,137,137
   ,137,137,176,178,2346
7A 3020 DATA173,179,137,137,137
   ,137,137,137,137,137,176,177
   ,203,202,137,137,2480
64 3030 DATA137,137,137,137,204
   ,205,202,137,203,137,137,137
   ,137,204,205,137,2593
35 3040 DATA137,137,202,207,207
   ,207,207,207,207,207,209,137
   ,137,203,202,207,3020
D9 3050 DATA207,203,202,203,137
   ,136,137,137,137,203,202,137
   ,137,137,137,136,2588
93 3060 DATA137,137,137,136,136
   ,136,136,137,136,137,137,136
   ,136,137,137,137,2185
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0B 3080 DATA137,136,136,137,137
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   ,137,207,207,209,2613
5A 3090 DATA204,205,136,136,136
   ,136,136,204,205,136,205,136
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1B 3100 DATA136,136,136,204,207
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   ,136,136,136,136,2315
7F 3110 DATA136,136,136,136,136
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F7 3120 DATA136,136,136,136,136
   ,136,136,136,136,136,136,136
   ,209,136,136,136,2249
E4 3130 DATA136,136,136,207,206
   ,206,206,209,210,136,136,136
   ,137,210,209,210,2826
11 3140 DATA210,209,206,207,207
   ,207,209,210,206,209,206,209
   ,206,207,136,137,3181
53 3150 DATA136,207,209,210,206
   ,207,207,136,136,136,136,137
   ,207,207,207,207,2891
43 3160 DATA136,136,136,137,136
   ,136,136,137,136,136,136,136
   ,136,136,136,136,2179
DC 3170 DATA136,136,207,136,136
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E4 3180 DATA137,136,136,136,209
   ,210,210,206,209,137,136,136
   ,136,207,210,206,2757
4A 3190 DATA136,203,202,203,136
   ,137,137,136,207,207,202,137
   ,136,202,203,203,2787
1E 3200 DATA202,137,137,207,137
   ,137,137,137,136,137,202,203
   ,137,137,137,137,2457
3A 3210 DATA136,137,136,137,203
   ,202,137,137,137,137,137,137
   ,137,137,137,202,2386
AC 3220 DATA136,137,137,137,136
   ,136,136,136,203,137,137,137
   ,202,203,137,137,2384
54 3230 DATA137,137,136,202,203
   ,137,137,203,137,136,137,137
   ,137,203,136,137,2452
8D 3240 DATA148,149,150,147,151
   ,152,180,181,146,146,146,151
   ,152,153,154,146,2452
53 3250 DATA182,183,180,181,146
   ,155,156,158,147,147,147,146
   ,182,183,146,146,2585
E7 3260 DATA146,146,146,146,146
   ,147,146,146,181,146,147,146
   ,147,147,146,147,2376
E7 3270 DATA146,180,183,146,147
   ,146,146,146,146,146,146,182
   ,146,146,146,146,2444
A7 3280 DATA146,147,146,147,146
   ,146,148,149,150,147,147,147
   ,146,180,181,146,2419
CD 3290 DATA151,152,153,154,147
   ,147,147,147,151,152,155,156
   ,157,158,148,149,2424
C0 3300 DATA150,146,155,156,147
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FC 3310 DATA150,146,147,147,147
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EF 3320 DATA147,147,151,152,146
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1D 3330 DATA147,147,147,147,180
   ,181,147,148,149,147,146,147
   ,146,146,182,183,2490
EC 3340 DATA146,180,181,146,146
   ,147,146,146,182,183,146,182
   ,183,147,147,146,2554
56 3350 DATA146,147,147,146,181
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80 3360 DATA146,146,146,146,146
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2B 3370 DATA146,146,180,181,147
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   ,182,183,146,146,2548
F1 3380 DATA147,146,146,147,182
   ,183,146,180,181,146,146,146
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98 3390 DATA151,152,153,147,146
   ,147,147,146,148,149,155,156
   ,157,147,147,146,2394
EB 3400 DATA147,146,147,148,147
   ,147,146,146,147,147,146,147
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5D 3410 DATA147,147,146,146,147
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6B 3430 DATA181,146,147,182,183
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   ,157,158,147,147,146,155,156
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96 3450 DATA146,148,149,150,146
   ,146,147,146,147,146,146,147
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17 3460 DATA146,147,147,147,146
   ,147,146,146,146,147,146,146
   ,147,146,146,147,2343
84 3470 DATA146,146,146,146,148
   ,149,150,151,152,153,154,147
   ,152,153,154,146,2393
DB 3480 DATA146,155,156,157,158
   ,146,156,157,158,148,152,153
   ,146,147,146,146,2427
91 3490 DATA156,157,158,147,146
   ,146,146,148,149,150,147,146
   ,147,146,146,146,2381
6F 3500 DATA147,147,146,147,147
   ,146,147,146,147,147,146,147
   ,146,147,147,146,2346
DF 3510 DATA146,146,147,147,146
   ,147,147,146,147,147,146,151
   ,152,153,154,146,2368
65 3520 DATA147,147,146,147,147
   ,155,156,157,158,147,180,181
   ,148,149,150,147,2462
C6 3530 DATA147,148,149,150,182
   ,183,147,146,151,152,153,146
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18 3540 DATA146,183,181,181,147
   ,147,146,146,182,183,181,146
   ,182,183,146,180,2660
9A 3550 DATA181,147,149,150,147
   ,146,146,147,147,182,183,146
   ,146,146,147,147,2457
E3 3560 DATA147,146,146,146,146
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   ,147,147,147,146,2343
92 3570 DATA147,146,146,147,147
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   ,180,181,146,146,2409
6C 3580 DATA146,147,147,147,151
   ,152,182,183,148,147,147,146
   ,146,150,155,156,2450
45 3590 DATA180,181,146,146,146
   ,147,147,148,149,150,182,183
   ,147,147,147,146,2492
1B 3600 DATA147,147,147,148,146
   ,147,147,146,146,147,147,147
   ,146,147,148,149,2352
25 3610 DATA150,146,147,146,146
   ,146,147,147,147,146,180,181
   ,147,147,147,147,2417
49 3620 DATA146,147,146,147,182
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    ,183,146,146,146,147,147,148
    ,147,180,181,146,2485
E7  3630 DATA147,147,146,146,151
    ,152,147,182,183,146,146,146
    ,146,147,155,156,2443
07  3640 DATA146,148,149,150,146
    ,146,147,147,147,146,149,150
    ,147,147,147,147,2359
76  3650 DATA146,146,148,149,146
    ,147,146,146,146,146,146,147
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04  3660 DATA146,147,147,147,147
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DE  3680 DATA146,146,146,146,146
    ,148,156,157,158,146,146,147
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AE  3690 DATA193,193,193,193,193
    ,193,193,193,193,193,193,193
    ,193,193,193,193,3088
FB  3700 DATA193,193,193,193,193
    ,193,193,193,193,193,193,193
    ,193,193,196,197,3095
3E  3710 DATA197,196,197,196,196
    ,197,196,197,146,147,147,146
    ,146,147,146,147,2744
7A  3720 DATA146,147,147,146,147
    ,147,146,147,146,147,146,147
    ,146,147,146,147,2345
73  3730 DATA147,146,147,146,147
    ,146,149,150,148,150,148,149
    ,150,146,180,181,2430
C4  3740 DATA193,198,199,184,185
    ,186,193,198,199,193,193,200
    ,201,187,188,189,3086
25  3750 DATA193,200,201,193,193
    ,193,193,190,191,192,193,193
    ,193,193,196,197,3104
96  3760 DATA196,196,197,196,196
    ,197,196,196,146,147,146,146
    ,147,146,147,147,2742
16  3770 DATA146,147,146,147,146
    ,146,147,146,147,147,146,148
    ,146,147,146,146,2344
51  3780 DATA147,147,146,151,152
    ,153,147,148,149,150,147,150
    ,147,155,156,157,2402
1F  3790 DATA176,177,178,137,136
    ,136,137,204,205,136,136,136
    ,136,136,137,137,2440
34  3800 DATA137,136,136,136,136
    ,136,137,136,136,136,137,137
    ,136,136,137,136,2181
5A  3810 DATA137,137,136,136,136
    ,136,136,136,137,136,136,136
    ,137,136,137,136,2181
46  3820 DATA137,136,203,136,164
    ,167,167,167,168,164,136,202
    ,159,161,164,162,2593
16  3830 DATA162,162,163,164,159
    ,160,160,159,164,162,162,162
    ,163,164,161,160,2587
2A  3840 DATA204,205,137,137,137
    ,136,136,176,177,178,137,137
    ,137,137,137,137,2445
D7  3850 DATA137,137,137,204,137
    ,136,136,137,137,136,137,137
    ,137,137,137,137,2256
EC  3860 DATA137,136,137,137,137
    ,137,173,179,137,137,137,136
    ,137,136,136,137,2266
3E  3870 DATA176,177,202,203,203
    ,137,202,203,137,137,137,137
    ,159,161,160,161,2692
28  3880 DATA159,159,161,160,159
    ,160,161,159,160,159,160,161
    ,160,159,160,161,2558
49  3890 DATA207,206,209,209,210
    ,206,136,209,210,206,207,136
    ,137,136,137,136,2897
D0  3900 DATA136,137,136,136,136
    ,136,137,137,137,137,137,136
    ,137,136,202,136,2249
B2  3910 DATA136,136,136,137,136
    ,136,136,136,203,202,136,136
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BE  3920 DATA137,136,202,203,202
    ,203,136,136,136,137,137,136
    ,160,159,161,160,2541
8C  3930 DATA161,159,160,159,160
    ,161,161,159,160,159,160,161
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F7  3940 DATA204,205,206,136,136
    ,136,136,210,207,206,137,137
    ,136,137,136,137,2602
7B  3950 DATA137,136,137,207,137
    ,136,137,136,137,136,136,137
    ,137,137,137,137,2257
CF  3960 DATA136,137,137,136,137
    ,136,136,137,137,137,136,137
    ,136,137,137,137,2186
6C  3970 DATA137,137,137,202,203
    ,202,203,137,137,137,136,137
    ,159,161,160,160,2545
6E  3980 DATA159,161,159,160,160
    ,161,160,161,159,161,160,159
    ,160,161,159,160,2560
B6  3990 DATA159,160,161,161,160
    ,159,159,160,161,159,159,161
    ,160,159,160,161,2559
B6  4000 DATA160,159,160,161,202
    ,203,202,137,137,202,203,137
    ,203,137,202,136,2741
A1  4010 DATA136,137,137,137,136
    ,137,136,137,203,136,136,136
    ,137,136,137,136,2250
DF  4020 DATA136,137,136,137,137
    ,137,136,137,137,136,136,137
    ,203,137,137,136,2252
FB  4030 DATA136,136,136,137,136
    ,137,204,205,136,137,137,137
    ,136,173,179,175,2437
BD  4040 DATA159,160,161,161,159
    ,160,159,160,161,159,161,159
    ,160,159,161,159,2558
FD  4050 DATA160,161,159,160,137
    ,202,203,137,137,136,137,202
    ,203,202,137,136,2609
93  4060 DATA136,136,137,136,137
    ,137,136,136,137,136,137,137
    ,136,137,136,136,2183
D9  4070 DATA137,137,137,136,137
    ,137,136,137,137,136,137,136
    ,137,137,136,136,2186
97  4080 DATA136,137,136,137,173
    ,179,128,129,130,137,136,137
    ,136,137,176,177,2321
60  4090 DATA159,161,164,162,162
    ,162,163,164,159,161,161,159
    ,164,162,162,162,2587
D0  4100 DATA163,164,160,159,136
    ,136,166,162,162,162,163,166
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DD  4110 DATA136,136,136,136,136
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    ,137,136,136,137,2178
6A  4120 DATA137,137,136,136,136
    ,137,137,137,137,136,137,136
    ,207,137,136,136,2255
DD  4130 DATA136,136,136,136,173
    ,179,207,207,136,136,137,137
    ,137,207,176,177,2553
47  4140 DATA160,159,159,161,160
    ,161,159,161,159,160,161,159
    ,160,160,159,160,2558
96  4150 DATA161,159,161,159,137
    ,202,203,136,203,137,137,203
    ,203,137,137,136,2611
70  4160 DATA136,136,137,137,136
    ,136,207,207,136,137,136,137
    ,136,137,137,136,2324
5A  4170 DATA137,206,136,136,136
    ,137,136,137,137,136,137,137
    ,204,205,136,136,2389
E0  4180 DATA136,136,137,137,136
    ,137,137,204,205,137,136,136
    ,136,128,129,130,2297
63  4190 DATA207,206,136,136,137
    ,136,136,137,137,137,207,137
    ,136,137,136,136,2394
19  4200 DATA136,202,203,202,137
    ,137,137,137,137,136,202,136
    ,160,159,137,136,2494
D1  4210 DATA136,136,136,203,137
    ,169,161,159,137,137,137,137
    ,137,202,170,161,2455
3C  4220 DATA161,160,137,136,136
    ,136,136,202,159,160,159,161
    ,205,137,137,137,2459
5D  4230 DATA136,203,160,159,161
    ,160,137,204,205,136,202,202
    ,202,203,170,161,2801
8B  4240 DATA203,202,136,136,136
    ,137,137,207,209,210,160,202
    ,137,137,137,137,2623
4C  4250 DATA136,136,136,206,170
    ,169,202,136,136,136,136,137
    ,207,209,161,161,2574
E2  4260 DATA203,137,137,136,136
    ,210,207,209,160,159,203,136
    ,137,137,137,137,2581
39  4270 DATA207,206,170,202,137
    ,137,137,136,136,137,137,206
    ,202,136,136,136,2558
C4  4280 DATA137,137,137,137,137
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    ,136,207,209,210,2469
C1  4290 DATA180,181,148,146,147
    ,146,146,147,180,181,182,183
    ,146,147,147,147,2554
90  4300 DATA147,147,182,183,146
    ,146,146,146,146,146,147,147
    ,148,149,146,146,2418
A2  4310 DATA146,146,146,146,146
    ,146,146,148,146,146,147,146
    ,147,146,147,146,2341
FF  4320 DATA147,146,146,146,147
    ,147,147,146,146,146,146,146
    ,150,146,146,148,2346
8A  4330 DATA149,150,147,147,147
    ,146,148,149,150,147,146,148
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40  4340 DATA0,104,0,104,16,104,
    0,104,0,104,0.104,0,104,0,10
    4,848
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PROGRAM: CODE SAVER

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AF  10 REM****************
B7  20 REM*  CODE SAVER *
BB  30 REM****************
8F  40 INPUT"[CLR]START ADDRESS"
    ;SA
92  50 INPUT "END ADDRESS";FA
36  60 INPUT "DEVICE NUMBER";DE
54  70 INPUT "FILE NAME";FI$
8E  80 POKE 194,SA/256:POKE193,S
    A-PEEK(194)*256
5B  90 POKE 175,FA/256:POKE174,F
    A-PEEK(175)*256
9D  100 L=LEN(FI$)
D6  110 FORI=1TOL:POKE1023+I,ASC
    (MID$(FI$,I,1)):NEXT
03  120 POKE187,0:POKE188,4:POKE
    183,L:POKE186,DE:SYS62954
```

PROGRAM: ACKROYDS SAGA

```
FD  10 A=A+1:PRINT"FILE"A:IFA=1T
    HENLOAD"CHARSET",8,1
07  20 IFA=2THENLOAD"SPRITES",8,
    1
62  30 IFA=3THENLOAD"OBJECT.1",8
    ,1
FC  40 IFA=4THENLOAD"HOUR-GLASS"
    ,8,1
1E  50 IFA=5THENLOAD"MAP",8,1
70  60 IFA=6THENLOAD"OBJECT.2",8
    ,1
34  70 POKE56,24:CLR
68  80 PRINT"[CLR,DOWN6]"TAB(10)
    "1...PLAY GAME"
90  90 PRINTTAB(10)"2...EDIT GAM
    E"
1A  100 GETI$:IFI$=""THEN100
D7  110 IF I$="2"THEN530
A7  120 IF I$<>"1"THEN100
BA  130 SYS32768
E2  140 PRINT"[HOME,WHITE,DOWN21
    ,RIGHT14]PRESS ANY KEY"
6D  150 GETI$:IFI$=""THEN150
5B  160 POKE 53272,21:PRINT"[CLR
    ,WHITE]":POKE53280,0:POKE532
    81,0:POKE53276,0:POKE53269,0
FD  170 FORI=53248TO53263:POKEI,
    0:NEXT
08  180 PC=PEEK(717)/PEEK(718)*1
    00
9E  190 LE=INT(PC/20)+1
8C  200 V=0:FORI=0TOLE:V=V+2↑I:N
    EXT
63  210 FORI=2040TO2047:POKEI,19
    4:NEXT
B1  220 RESTORE:FORI=1TOLE:READC
    O:NEXT
D0  230 Y=49:X=30:FOR J=1TOLE
1C  240 POKE 53287+J-1,CO
8C  250 POKE 53248+2*(J-1),X
9D  260 POKE 53249+2*(J-1),Y
AB  270 Y=Y+25:X=X+30:NEXT
F3  280 POKE 53277,V:POKE 53271,
    V:POKE 53269,V
17  290 DATA 9,12,6,3,7,1
8B  300 DATA PHOENIX,BLOB,FIRE,S
    NAKE,CLOUD,WHIRLWIND
CB  310 DATA SOLDIER,EAGLE,WIZAR
    D,GNOME,ZOMBIE
04  320 PRINT"[HOME,DOWN3]"TAB(1
    0);
74  330 ONLE GOTO 340,370,390,41
    0,430,450,63999
E6  340 PRINT"YOU'VE DIDN'T DO V
    ERY WELL"
B5  350 PRINTTAB(10)"IT'S BACK T
    O KNIGHT SCHOOL"
B9  360 PRINTTAB(10)"FOR YOU":GO
    TO470
A8  370 PRINT"NOT SO GOOD. YOU W
    ON'T KILL"
50  380 PRINTTAB(10)"MANY DRAGO
    NS THAT WAY!!":GOTO470
98  390 PRINT"HMMMM A LITTLE PRA
    CTICE"
94  400 PRINTTAB(10)"WON'T DO Y
    OU ANY HARM":GOTO470
85  410 PRINT"KEEP AT IT - YOU'L
    L SOON"
8A  420 PRINTTAB(10)"BECOME A K
    NIGHT"      :GOTO470
2E  430 PRINT"VERY GOOD - THE KI
    NG GIVES"
6C  440 PRINTTAB(10)"YOU A HERO
    MEDAL"      :GOTO470
C8  450 PRINT"WOW - YOU ARE PROM
    OTED TO"
C7  460 PRINTTAB(10)"KNIGHT THI
    RD CLASS"   :GOTO470
4F  470 PRINT"[HOME,DOWN23,SPC7]
    PRESS ANY KEY TO PLAY AGAIN"
90  480 GETI$:IFI$=""THEN480
17  490 POKE 53269,0:POKE53277,0
    :POKE53271,0
D0  500 FORI=53248TO53263:POKEI,
    0:NEXT
C7  510 POKE 53270,200
8B  520 GOTO80
7B  530 PRINT"[CLR,DOWN6]"TAB(10
    )"1...CHANGE TIMINGS"
A9  540 PRINTTAB(10)"2...CHANGE
    # SUMS"
0F  550 GETI$:IFI$=""THEN550
88  560 IFI$="1"THEN710
B5  570 IFI$<>"2"THEN550
92  580 RESTORE:FORI=1TO6:READZ:
    NEXT
15  590 PRINT"[CLR,SPC5]CURRENT
    VALUES ARE:"
07  600 PRINT"[DOWN4]"
72  610 FOR N=1TO11
C4  620 T=PEEK(34610+N):READN$
05  630 PRINT"NASTY"N"("N$"):"T"
    SUMS"
00  640 NEXT
85  650 INPUT"[DOWN3]NASTY TO BE
    ALTERED (0 TO EXIT)";N
DB  660 IFN<0ORN>11THEN650
A4  670 IFN=0THEN80
CF  680 INPUT "# OF SUMS (1 TO 5
    )";S
A7  690 IFS<0ORS>9THEN680
AA  700 POKE 34610+N,S:GOTO580
7D  710 PRINT"[CLR,SPC5]CURRENT
    VALUES ARE:"
8F  720 PRINT"[DOWN4]"
43  730 FOR L=1TO5
C0  740 T=PEEK(34621+L)/6
A1  750 PRINT"LEVEL"L":"T" SECS"
78  760 NEXT
B0  770 INPUT"[DOWN3]LEVEL TO BE
    CHANGED (0 TO EXIT)";L
0C  780 IFL<0ORL>5THEN770
43  790 IFL=0THEN80
F7  800 INPUT "NEW VALUE >0 AND
    <42 SECONDS";S
80  810 IF S<1 OR S>42 THEN800
ED  820 POKE 34621+L,S*6
FE  830 GOTO710
```

PROGRAM: PROGRAM 1

```
CF  0 REM ENLARGE (PROGRAM 1)
5A  2 I=49152
B8  3 CK=0:IF PEEK(49153)=8 AND
    PEEK(49154)=162 THEN GOTO 11
    5
81  4 PRINT"[CLR,RVSON]PLEASE WA
    IT !!"
AA  5 READ A:IF A=256 THEN PRINT
    "[RVSON]OK !!":GOTO 115
E1  6 POKE I,A:I=I+1:CK=CK+A:GOT
    O 5
32  7 IF CK<>103578 THEN PRINT"[
    RVSON]ERROR !!":END
49  8 DATA 0,8,162,0,142,0,192,1
    69
2F  9 DATA 8,141,1,192,162,1,134
    ,251
ED  10 DATA 169,1,133,250,10,10,
    10,141
75  11 DATA 64,192,174,0,192,189
    ,0,56
99  12 DATA 141,160,192,78,160,1
    92,8,104
12  13 DATA 170,138,72,160,0,132
    ,254,140
8A  14 DATA 51,192,160,0,185,0,4
    8,40
04  15 DATA 106,8,153,0,48,152,2
    4,105
04  16 DATA 1,141,51,192,230,254
    ,164,254
AE  17 DATA 204,13,192,208,229,1
    04,198,251
63  18 DATA 208,215,173,13,192,1
    33,251,206
1F  19 DATA 1,192,208,199,169,8,
    141,1
24  20 DATA 192,198,250,208,36,1
    73,17,192
2E  21 DATA 133,250,238,0,192,17
    3,0,192
F6  22 DATA 201,8,208,21,173,53,
    192,24
FD  23 DATA 105,1,141,53,192,141
    ,59,192
13  24 DATA 144,6,238,54,192,238
    ,60,192
25  25 DATA 96,173,53,192,24,105
    ,1,141
62  26 DATA 53,192,141,59,192,14
    4,131,238
18  27 DATA 54,192,238,60,192,24
    ,144,245
1A  28 DATA 0,162,0,142,0,4,24,1
    73
D2  29 DATA 164,192,105,1,141,16
    4,192,144
71  30 DATA 3,238,165,192,56,165
    ,250,233
63  31 DATA 1,133,250,176,2,198,
    251,165
A7  32 DATA 251,208,224,165,250,
    208,220,96
C9  33 DATA 173,14,220,41,254,14
    1,14,220
D4  34 DATA 165,1,41,251,133,1,1
    73,0
04  35 DATA 208,141,0,56,24,173,
    215,192
BE  36 DATA 105,1,141,215,192,14
    4,4,238
1C  37 DATA 216,192,24,173,218,1
    92,105,1
19  38 DATA 141,218,192,144,3,23
    8,219,192
89  39 DATA 56,165,250,233,1,133
    ,250,176
6E  40 DATA 2,198,251,165,251,20
    8,207,165
07  41 DATA 250,208,203,165,1,9,
    4,133
A3  42 DATA 1,173,14,220,9,1,141
    ,14
93  43 DATA 220,96,169,0,160,0,3
    2,145
A4  44 DATA 179,32,12,188,169,0,
    160,40
95  45 DATA 32,145,179,32,43,186
    ,32,12
BD  46 DATA 188,169,0,160,0,32,1
    45,179
03  47 DATA 32,106,184,32,247,18
    3,169,0
7A  48 DATA 24,101,20,141,95,193
```

```
   .169,4
93 49 DATA 101,21,141,96,193,16
   9,0,24
35 50 DATA 101,20,141,97,193,16
   9,216,101
E2 51 DATA 21,141,98,193,96,1,1
   ,0
FE 52 DATA 0,0,0,0,169,1,141,99
BD 53 DATA 193,173,95,193,133,2
   52,173,96
47 54 DATA 193,133,253,173,97,1
   93,133,254
49 55 DATA 173,98,193,133,255,1
   62,1,160
3B 56 DATA 0,173,93,193,238,93,
   193,145
D0 57 DATA 252,173,94,193,145,2
   54,165,252
3B 58 DATA 24,105,40,133,252,14
   4,2,230
63 59 DATA 253,165,254,24,105,4
   0,133,254
1F 60 DATA 144,2,230,255,202,20
   8,216,173
B9 61 DATA 95,193,24,105,1,141,
   95,193
2E 62 DATA 144,3,238,96,193,173
   ,97,193
62 63 DATA 24,105,1,141,97,193,
   144,3
57 64 DATA 238,98,193,206,99,19
   3,208,161
7C 65 DATA 96,32,43,195,141,53,
   192,141
4C 66 DATA 59,192,140,54,192,14
   0,60,192
1C 67 DATA 96,32,43,195,141,30,
   192,140
48 68 DATA 31,192,96,32,43,195,
   141,94
98 69 DATA 193,96,32,43,195,141
   ,93,193
A4 70 DATA 96,32,43,195,201,40,
   144,3
92 71 DATA 76,72,178,141,52,193
   ,32,43
AA 72 DATA 195,201,25,144,3,76,
   72,178
22 73 DATA 141,29,193,32,26,193
   ,96,32
9B 74 DATA 43,195,201,0,208,3,7
   6,72
5E 75 DATA 178,141,13,192,141,1
   01,193,32
41 76 DATA 43,195,201,0,208,3,7
   6,72
D8 77 DATA 178,141,17,192,141,1
   26,193,172
13 78 DATA 13,192,136,169,0,32,
   145,179
E5 79 DATA 32,12,188,169,0,160,
   8,32
2E 80 DATA 145,179,32,43,186,32
   ,12,188
E4 81 DATA 172,17,192,169,0,32,
   145,179
BB 82 DATA 32,43,186,32,12,188,
   169,0
45 83 DATA 160,1,32,145,179,32,
   106,184
CD 84 DATA 32,247,183,165,20,14
   1,121,192
81 85 DATA 96,32,43,195,141,215
   ,192,140
8E 86 DATA 216,192,32,43,195,14
   1,218,192
E2 87 DATA 140,219,192,32,43,19
   5,133,250
67 88 DATA 132,251,32,200,192,9
   6,32,43
56 89 DATA 195,141,164,192,140,
   165,192,32
77 90 DATA 43,195,133,250,132,2
   51,32,43
C6 91 DATA 195,141,162,192,32,1
   61,192,96
84 92 DATA 32,43,195,201,40,144
   ,3,76
F9 93 DATA 72,178,72,32,43,195,
   201,25
8C 94 DATA 144,3,76,72,178,24,1
   70,104
3D 95 DATA 168,32,240,255,96,32
   ,225,194
84 96 DATA 32,253,174,32,214,19
   4,134,253
DC 97 DATA 132,254,32,230,225,1
   66,253,164
73 98 DATA 254,169,251,76,95,22
   5,32,138
8C 99 DATA 173,32,247,183,166,2
   0,164,21
6E 100 DATA 96,162,1,160,0,169,
   0,32
E2 101 DATA 186,255,32,121,0,24
   0,14,32
13 102 DATA 87,226,32,253,174,3
   2,214,194
0C 103 DATA 134,251,132,252,96,
   162,11,76
4A 104 DATA 55,164,169,0,133,10
   ,32,225
C7 105 DATA 194,32,230,225,165,
   10,166,251
A9 106 DATA 164,252,32,213,255,
   144,3,76
A7 107 DATA 249,224,165,10,240,
   3,76,126
4A 108 DATA 225,32,183,255,41,1
   91,240,212
12 109 DATA 76,156,225,32,253,1
   74,32,138
66 110 DATA 173,32,247,183,165,
   20,164,21
82 111 DATA 96,256
49 115 :
```

PROGRAM: PROGRAM 2

```
READY.

25 119 REM ENLARGE (PROGRAM 2)
16 120 PC=49508:DS=49609:CD=496
   25:CC=49635:BC=49642
F6 130 XY=49649:WH=49679:EC=491
   54:MC=49769:MF=49798:CM=4982
   4
E0 135 MS=49853:ML=49922:REM MS
   AVE/MLOAD
B6 140 :
E6 150 SYS MC,53248,14336,2048:
   SYS MC,53248,15872,512:SYS M
   C,55296,14848,512
72 160 SYS MF,12288,8,0:REM "@"
    NOW = " "
AF 170 SYS DS,12296:REM DATA ST
   ORE
A1 180 SYS CD,14336:REM CHAR DA
   TA
E1 190 SYS MF,1024,1000,0:REM C
   LEAR USING @
01 200 POKE 53272,(PEEK(53272)A
   ND240)+12
E1 210 SYS BC,1:REM SET BASE CH
   ARACTER
5F 220 GOTO 1000:REM START PROG
DC 230 :
9D 240 REM ROUTINE TO PRINT CHA
   RACTERS
EA 250 SYS XY,X,Y:SYS WH,WIDTH,
   HEIGHT:SYS CC,COL
33 260 FOR A=1 TO LEN(TEXT$)
5F 270 C$=MID$(TEXT$,A,1):V%=AS
   C(C$)
A9 290 SYS CD,14336+(V%*8):SYS
   EC:SYS PC:NEXT A:RETURN
D0 999 :
81 1000 REM SHOW HOW TO USE
8C 1010 POKE53281,0:POKE53280,0
   :POKE646,1
73 1020 TEXT$="YOUR COMMODORE":
   X=6:Y=0:WIDTH=2:HEIGHT=2:COL
   =1:GOSUB250
F8 1030 TEXT$="PRESENTS":X=0:Y=
   4:WIDTH=5:HEIGHT=1:COL=3:GOS
   UB250
56 1040 X=6:Y=9:WIDTH=4:HEIGHT=
   3
82 1050 Z$="ENLARGE"
60 1060 FOR L1=1 TO LEN(Z$):TEX
   T$=MID$(Z$,L1,1):COL=(L1 AND
    7)+1:GOSUB250:X=X+4
CD 1070 NEXT L1
B8 1080 TEXT$="WRITTEN BY A.WRI
   GHT":X=1:Y=15:WIDTH=2:HEIGHT
   =1:COL=5:GOSUB250
A7 1090 GET K$:IF K$="" THEN 10
   90
```

PROGRAM: ARRAY LOADER

```
READY.

5A 10 A=49152
8D 20 FORI=0TO115
3C 25 C=0
65 30 FORJ=0TO6
00 50 READK
0B 60 POKEA,K
57 70 A=A+1:C=C+K:T=T+K
D2 80 NEXT
F5 90 READL:IFC<>LTHENPRINT"DAT
   A ERROR IN LINE"I+200:END
E6 100 NEXT
1C 110 IFT<>92881THENPRINT"ERRO
   R SOMEWHERE IN DATA!"
F8 120 END
C2 200 DATA76,9,192,76,135,193,
   76,757
2C 201 DATA0,195,32,120,192,169
   ,0,708
6E 202 DATA141,66,3,238,66,3,17
   3,690
8A 203 DATA66,3,32,218,192,160,
   0,671
10 204 DATA177,100,204,67,3,144
   ,2,697
73 205 DATA169,32,32,62,192,145
   ,251,883
24 206 DATA173,134,2,145,253,20
   0,204,1111
04 207 DATA65,3,208,231,173,66,
   3,749
4C 208 DATA205,64,3,208,212,96,
   72,860
9E 209 DATA41,15,141,77,3,104,4
   1,422
E7 210 DATA112,74,74,74,74,170,
   189,767
```

```
2D  211 DATA104,192,13,77,3,96,72,557
05  212 DATA41,15,141,77,3,104,41,422
DC  213 DATA112,74,74,74,74,170,189,767
DF  214 DATA112,192,13,77,3,96,0,493
FE  215 DATA16,32,48,0,16,64,80,256
66  216 DATA64,80,32,48,96,112,64,496
2C  217 DATA80,32,115,0,32,138,173,570
9E  218 DATA165,71,72,165,72,72,32,649
1E  219 DATA115,0,32,138,173,165,71,694
B7  220 DATA72,165,72,72,32,115,0,528
97  221 DATA32,158,173,32,143,173,165,876
1F  222 DATA71,133,109,165,72,133,110,793
BD  223 DATA104,133,108,104,133,107,104,793
0A  224 DATA133,106,104,133,105,160,1,742
22  225 DATA177,107,141,64,3,160,1,653
CC  226 DATA177,105,141,78,3,165,105,774
D9  227 DATA141,68,3,165,106,141,69,693
FD  228 DATA3,165,107,141,70,3,165,654
42  229 DATA108,141,71,3,165,109,141,738
9C  230 DATA72,3,165,110,141,73,3,567
8B  231 DATA96,170,10,24,109,68,3,480
23  232 DATA133,105,169,0,109,69,3,588
72  233 DATA133,106,138,10,24,109,70,590
55  234 DATA3,133,107,169,0,109,71,592
59  235 DATA3,133,108,138,141,74,3,600
6D  236 DATA10,24,109,74,3,24,109,353
34  237 DATA72,3,133,109,169,0,109,595
E0  238 DATA73,3,133,110,160,1,177,657
65  239 DATA105,133,251,133,253,24,136,1035
EC  240 DATA177,105,105,4,133,252,24,800
64  241 DATA105,212,133,254,200,177,107,1188
8F  242 DATA141,65,3,160,0,177,109,655
DB  243 DATA141,67,3,200,177,109,133,830
6F  244 DATA100,200,177,109,133,101,96,916
36  245 DATA172,65,3,136,192,255,240,1063
A2  246 DATA47,177,251,201,32,240,245,1193
D1  247 DATA200,140,67,3,152,32,125,719
F9  248 DATA180,160,0,177,251,32,83,883
B5  249 DATA192,145,98,200,204,67,3,909
8D  250 DATA208,243,160,0,173,67,3,854
38  251 DATA145,109,200,165,98,145,109,971
EF  252 DATA200,165,99,145,109,96,160,974
FE  253 DATA0,152,145,109,96,160,0,662
A8  254 DATA177,251,41,127,145,251,200,1192
F9  255 DATA204,65,3,208,244,96,32,852
B0  256 DATA120,192,169,1,141,66,3,692
50  257 DATA173,78,3,240,3,141,66,704
3C  258 DATA3,173,66,3,32,218,192,687
4C  259 DATA160,0,177,251,9,128,145,870
FC  260 DATA251,173,134,2,145,253,200,1158
0D  261 DATA204,65,3,208,239,169,0,888
31  262 DATA141,75,3,172,75,3,177,646
A4  263 DATA251,141,76,3,169,228,145,1013
39  264 DATA251,169,255,141,74,3,206,1099
C5  265 DATA74,3,240,10,32,195,194,748
88  266 DATA32,228,255,240,243,208,26,1232
50  267 DATA173,76,3,172,75,3,145,647
0D  268 DATA251,169,255,141,74,3,206,1099
06  269 DATA74,3,240,214,32,195,194,952
0E  270 DATA32,228,255,240,243,72,172,1242
BC  271 DATA75,3,173,76,3,145,251,726
2C  272 DATA104,201,32,144,28,201,96,806
89  273 DATA176,24,32,62,192,9,128,623
41  274 DATA145,251,200,238,75,3,204,1116
A1  275 DATA65,3,208,5,169,0,141,591
9B  276 DATA75,3,76,181,193,201,29,758
96  277 DATA240,235,201,157,208,18,206,1265
13  278 DATA75,3,136,192,255,208,237,1106
59  279 DATA172,65,3,136,140,75,3,594
20  280 DATA76,181,193,201,17,208,24,900
EA  281 DATA32,120,193,238,66,3,173,825
4A  282 DATA66,3,205,64,3,144,7,492
23  283 DATA240,5,169,1,141,66,3,625
27  284 DATA76,143,193,201,145,208,25,991
62  285 DATA32,120,193,173,66,3,201,788
3D  286 DATA1,240,6,206,66,3,76,598
66  287 DATA143,193,173,64,3,141,66,783
C3  288 DATA3,76,143,193,201,13,240,869
89  289 DATA54,201,19,208,8,169,0,659
89  290 DATA141,75,3,76,181,193,201,870
8F  291 DATA147,208,15,160,0,169,160,859
5E  292 DATA145,251,200,204,65,3,208,1076
27  293 DATA248,76,116,194,201,20,208,1063
BB  294 DATA6,32,201,194,76,33,194,736
65  295 DATA201,148,208,6,32,223,194,1012
B5  296 DATA76,181,193,76,181,193,32,932
5B  297 DATA120,193,169,0,141,66,3,692
59  298 DATA238,66,3,173,66,3,32,581
44  299 DATA218,192,32,59,193,173,66,933
91  300 DATA3,205,64,3,208,236,96,815
BE  301 DATA162,128,202,208,253,96,192,1241
E6  302 DATA0,240,17,177,251,136,145,966
74  303 DATA251,200,200,204,65,3,144,1067
4A  304 DATA244,136,169,160,145,251,96,1201
D3  305 DATA140,74,3,200,204,65,3,689
D8  306 DATA240,16,172,65,3,136,136,768
BC  307 DATA177,251,200,145,251,136,204,1364
9E  308 DATA74,3,208,244,172,74,3,778
1E  309 DATA169,160,145,251,96,32,120,973
61  310 DATA192,169,0,141,66,3,238,809
34  311 DATA66,3,173,66,3,32,218,561
12  312 DATA192,160,0,169,32,145,251,949
57  313 DATA200,204,65,3,208,248,173,1101
D4  314 DATA66,3,205,64,3,208,227,776
F1  315 DATA96,0,0,0,0,0,0,96
```

```
E1  100 REM ***********************
47  110 REM ** SET UP ARRAY DEFS **
2D  120 REM ***********************
C5  130 DIMP%(30),L%(30),S$(30)
57  140 READL
AC  150 L%(0)=L
52  160 FORI=1TOL:READP%(I),L%(I):NEXT
62  170 DATA29
81  180 DATA132,9,152,7,213,26,299,3,316,3
4F  190 DATA401,19,441,19,481,19,521,19,561,19,605,15
94  200 DATA421,18,461,18,501,18,541,18,581,18,625,14
00  210 DATA721,19,761,19,801,19,841,19,881,19,925,15
CD  220 DATA741,18,781,18,821,18,861,18,901,18,945,14
B3  230 REM ************************
66  240 REM ** SET UP EXAMPLE DATA **
CF  250 REM ************************
2A  260 FORI=1TOL:READS$(I):NEXT
```

```
D6  270 DATAZXY-335,WDG447
6E  280 DATACOMPRESSION WIDGET
73  290 DATA200,500
FF  300 DATAFLAKEY & CO,SECTION
    C,INDUSTRIAL ESTATE,BIGTOWN,
    SUSSEX,(0228) 542234
FF  310 DATAWORMEX LTD,TRADE SAL
    ES,7 MANOR ROAD,FROODELCHEST
    ER,FC23 5QQ,(0344) 60393
84  320 DATAHONEST JIM'S,THE YAR
    D,NR RAILWAY STATION,SPLOTBU
    RY,SP4 6JC,(0932) 54223
54  330 DATA,,,,
FA  340 REM ********************
    ****
A8  350 REM ** DRAW SCREEN LAYOU
    T **
46  360 REM ********************
    ****
C0  370 POKE53280,0:POKE53281,0
4C  380 PRINT"[CLR,YELLOW]";
17  390 PRINT" THIS IS AN EXAMPL
    E SCREEN TO SHOW HOW"
02  400 PRINT"[SPC5]THE ARRAY SU
    BROUTINES ARE USED[GREEN]
51  410 PRINT"[CA,S*20,CR,S*17,C
    S]";
46  420 PRINT"[S-]STOCK CODE:[SP
    C9,S-]REFERENCE:[SPC7,S-]";
70  430 PRINT"[CQ,S*20,CE,S*17,C
    W]";
1F  440 PRINT"[S-]DESCRIPTION:[S
    PC26,S-]";
19  450 PRINT"[CQ,S*22,CR,S*15,C
    W]";
92  460 PRINT"[S-]QUANTITY IN ST
    OCK:[SPC4,S-]MAX ALLOWED:[SP
    C3,S-]";
AA  470 PRINT"[CQ,S*19,CR,S*2,CE
    ,S*15,CW]";
FF  480 PRINT"[S-]SUPPLIER #1:[S
    PC7,S-]SUPPLIER #2:[SPC6,S-]
    ";
2E  490 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
24  500 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
22  510 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
0B  520 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
09  530 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
AF  540 PRINT"[S-]TEL:[SPC15,S-]
    TEL:[SPC14,S-]";
D9  550 PRINT"[CQ,S*19,CE,S*18,C
    W]";
3E  560 PRINT"[S-]SUPPLIER #3:[S
    PC7,S-]SUPPLIER #4:[SPC6,S-]
    ";
61  570 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
57  580 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
45  590 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
3B  600 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
B9  610 PRINT"[S-,SPC19,S-,SPC18
    ,S-]";
DF  620 PRINT"[S-]TEL:[SPC15,S-]
    TEL:[SPC14,S-]";
71  630 PRINT"[CZ,S*19,CE,S*18,C
    X,HOME,WHITE]";
66  640 REM POKE ONTO LAST SCREE
    N CHR AS IT
BC  650 REM WOULD APPEAR IF PRIN
    TED
8D  660 POKE2023,125:POKE56295,5
4F  670 REM ********************
    ****
E2  680 REM ** DISPLAY ARRAY DAT
    A **
5B  690 REM ********************
    ****
95  700 SYS49152,P%(0),L%(0),S$(
    0)
3D  710 REM ********************
    **********
30  720 REM ** ALLOW USER TO EDI
    T SCREEN **
49  730 REM ********************
    **********
CC  740 SYS49155,P%(0),L%(0),S$(
    0)
75  750 REM ********************
    **********
72  760 REM ** CLEAR SCREEN ARRA
    Y FIELDS **
80  770 REM ********************
    **********
04  780 SYS49158,P%(0),L%(0),S$(
    0)
56  790 REM ********************
    *******
9E  800 REM ** EXIT FROM PROGRAM
     WITH **
EC  810 REM **  ARRAY S$  CONTAI
    NING  **
E9  820 REM **         EDITED DATA
     **
EE  830 REM ********************
    *******
```

PROGRAM: VEHICLES.DATA

```
AF  10 REM**********************
    *
2E  20 REM*   SPRITES LIRBARY
    *
30  30 REM*   ---------------
    *
C4  40 REM*  VEHICLES SPRITES
    *
CE  50 REM*  BASIC DATA LOADER
    *
99  60 REM* SPRITES DESIGNED BY
    *
74  70 REM*       MIKE BENN
    *
C5  80 REM**********************
    *
DD  90 BL=255  :LN=190  :SA=1024
    0
89  100 FOR L=0 TO BL:CX=0:FOR D
    =0 TO 15
4F  110 READ A:IF A>255THENPRINT
    "NUMBER TO LARGE";LN+(L*10):
    STOP
98  120 CX=CX+A:POKE SA+L*16+D,A
    :NEXT D
D9  130 READ A:IF A<>CX THENPRIN
    T"ERROR IN LINE";LN+(L*10):S
    TOP
37  140 NEXTL:POKE43,0:POKE44,40
    :POKE45,0:POKE46,56
00  150 SAVE"VEHICLES",8,1:END
EF  160 REM*********************
    ***********
3B  170 REM TAPE USERS WILL NEED
     TO CHANGE         DEVICE N
    UMBER FROM 8 TO 1
FB  180 REM*********************
    ***********
2D  190 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
99  200 DATA 2,160,0,0,192,0,0,8
    5,0,5,64,0,26,64,0,160,758
01  210 DATA 80,0,129,132,0,129,
    36,2,4,33,2,4,33,2,1,85,672
DB  220 DATA 0,128,32,0,128,32,0
    ,128,128,0,32,128,0,10,0,95,
    841
11  230 DATA 0,0,0,0,0,0,0,0,0,2
    ,192,0,0,208,0,0,402
38  240 DATA 16,0,0,16,0,85,80,0
    ,0,85,0,1,26,64,1,18,392
9C  250 DATA 0,4,144,128,6,16,32
    ,18,16,32,18,4,32,194,0,32,6
    76
6F  260 DATA 194,0,32,2,0,32,0,1
    28,128,0,34,0,0,42,0,0,592
5C  270 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
B1  280 DATA 0,0,0,0,0,0,2,0,0,2
    ,128,2,86,165,0,2,387
3B  290 DATA 128,0,2,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,130
BE  300 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
1C  310 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,176,0,0,176
BF  320 DATA 48,0,0,48,0,0,48,0,
    0,48,0,85,117,160,0,48,602
51  330 DATA 0,0,48,0,0,48,0,0,4
    8,0,0,176,0,0,0,0,320
86  340 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,1,1
C0  350 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,44,0,0,12,0,56
5C  360 DATA 168,2,0,48,0,0,21,8
    5,1,80,0,6,144,0,24,20,599
C1  370 DATA 0,32,97,0,32,72,64,
    129,8,64,129,8,16,128,85,85,
    949
25  380 DATA 32,8,56,32,8,0,32,3
    2,0,8,32,0,2,128,0,26,396
D7  390 DATA 0,0,0,0,0,0,0,0,0,0
    ,44,0,0,13,0,160,217
30  400 DATA 1,0,192,1,0,85,85,0
    ,64,5,80,64,17,164,64,17,839
CB  410 DATA 32,64,73,8,64,97,2,
    65,33,2,65,32,66,84,32,2,721
32  420 DATA 56,32,2,0,32,2,0,8,
    8,0,2,32,0,2,160,255,591
3C  430 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
CB  440 DATA 0,44,0,0,12,0,0,12,
    0,128,14,0,160,14,149,169,70
    2
42  450 DATA 94,0,160,14,0,128,1
    4,0,0,12,0,0,44,0,0,0,466
7A  460 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,27,27
04  470 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
A3  480 DATA 11,0,0,3,0,0,3,0,0,
    3,0,128,3,0,165,87,403
B3  490 DATA 86,128,3,0,0,3,0,0,
    3,0,0,11,0,0,0,0,234
92  500 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,26,26
6C  510 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0
A5  520 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,170,170
E3  530 DATA 160,0,170,160,1,85,
    64,1,85,64,1,85,64,1,105,64,
    1110
18  540 DATA 1,190,85,3,190,85,0
    ,190,0,0,190,0,0,40,0,16,990
```

```
03 550 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,176,176
72 560 DATA 0,0,48,0,0,4,0,0,4,0,0,5,0,0,9,0,70
64 570 DATA 0,9,0,0,9,0,0,9,84,0,9,64,0,9,40,0,233
83 580 DATA 85,190,0,85,190,0,0,190,0,0,190,0,0,40,0,27,997
83 590 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
90 600 DATA 0,0,0,0,0,0,1,85,1,170,154,1,170,165,1,170,918
11 610 DATA 165,1,170,165,1,170,154,0,1,85,0,0,0,0,0,0,912
1B 620 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,17,17
EB 630 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
5E 640 DATA 0,0,180,0,0,93,0,0,157,0,0,93,86,0,93,86,788
10 650 DATA 0,93,86,0,157,0,0,93,0,0,180,0,0,0,0,0,609
35 660 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,208,208
33 670 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
43 680 DATA 0,0,0,0,0,0,42,170,0,106,149,0,101,85,0,41,694
C4 690 DATA 255,0,169,127,2,134,159,2,4,191,2,4,159,2,5,85,1300
9A 700 DATA 2,63,249,2,128,176,0,130,128,0,170,0,0,42,0,74,1164
E4 710 DATA 0,0,0,0,0,0,0,0,0,0,0,0,11,192,0,0,203
54 720 DATA 80,0,21,80,0,85,64,0,85,85,0,85,106,64,205,106,1066
16 730 DATA 0,184,66,128,238,64,128,178,16,160,50,4,32,130,0,32,1410
3C 740 DATA 226,0,32,2,128,160,0,162,128,0,42,0,0,8,0,0,888
63 750 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
6C 760 DATA 0,0,0,0,0,0,0,0,0,42,169,2,106,170,2,106,597
E1 770 DATA 170,2,106,170,0,42,169,0,0,0,0,0,0,0,0,0,659
5C 780 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
07 790 DATA 0,0,0,0,0,0,0,0,0,8,0,0,3,0,0,3,14
67 800 DATA 0,0,0,192,0,0,192,0,85,208,0,85,213,96,85,213,1369
BC 810 DATA 96,85,213,96,85,208,0,0,192,0,0,192,0,3,0,0,1170
8B 820 DATA 8,0,0,0,0,0,0,0,0,0,0,0,0,0,0,44,52
97 830 DATA 0,0,0,5,85,85,21,85,85,21,85,85,21,85,85,21,769
8A 840 DATA 85,85,21,85,85,21,85,85,21,85,85,0,0,0,21,85,849
61 850 DATA 85,21,85,85,21,85,85,21,85,85,21,165,85,22,169,85,1205
6B 860 DATA 22,169,85,150,249,85,2,248,0,2,168,0,0,160,0,200,1540
40 870 DATA 0,0,0,85,64,0,95,192,0,95,192,0,95,192,0,95,1105
BC 880 DATA 240,0,95,240,0,95,240,0,95,240,0,0,5,64,85,85,1484
DD 890 DATA 80,85,85,84,85,85,84,85,85,84,85,86,148,85,90,164,1500
F8 900 DATA 85,90,164,85,91,224,0,11,224,0,10,160,0,2,128,9,1283
33 910 DATA 0,0,0,0,0,0,21,85,85,149,85,85,149,85,85,149,978
E4 920 DATA 85,85,149,85,85,149,85,85,149,85,85,149,85,85,149,85,1680
6C 930 DATA 85,149,85,85,149,85,85,149,85,85,149,85,85,149,85,85,1680
9F 940 DATA 149,85,85,21,85,85,0,0,0,0,0,0,0,0,0,211,721
24 950 DATA 0,0,0,0,0,0,85,85,64,95,117,84,85,117,84,85,901
40 960 DATA 117,84,85,117,84,85,117,84,85,117,84,85,117,84,85,117,1547
C5 970 DATA 84,85,117,84,85,117,84,85,117,84,85,117,84,85,117,84,1514
C1 980 DATA 95,117,84,85,85,64,0,0,0,0,0,0,0,0,0,1,531
71 990 DATA 0,0,0,21,85,84,21,85,85,21,85,85,21,85,85,21,784
AA 1000 DATA 85,85,21,85,85,21,85,85,21,85,85,0,0,0,21,85,849
09 1010 DATA 85,21,85,85,21,85,85,21,85,85,21,165,85.22.168,0,1119
7A 1020 DATA 38,169,85,2,249,85,2,248,0,2,168,0,0,160,0,32,1240
CD 1030 DATA 0,0,0,0,0,0,0,0,0,84,0,0,252,0,0,255,591
7B 1040 DATA 0,0,255,0,0,255,192,0,255,192,0,255,240,0,85,85,1814
E8 1050 DATA 64,85,85,85,85,85,85,85,85,85,85,86,149,0,10,165,1324
8C 1060 DATA 85,90,166,85,91,224,0,11,224,0,10,160,0,2,128,123,1399
A7 1070 DATA 0,0,0,0,0,0,21,85,85,21,85,85,21,85,85,21,594
1C 1080 DATA 85,85,21,85,85,21,85,85,21,85,85,21,85,85,21,85,1040
E2 1090 DATA 85,21,85,85,21,85,85,21,85,85,21,85,85,21,85,85,1040
6A 1100 DATA 21,85,85,21,85,85,21,85,85,0,0,0,0,0,0,219,792
8D 1110 DATA 0,0,0,0,0,0,0,0,0,85,85,80,255,117,84,253,959
48 1120 DATA 245,84,87,245,84,87,245,84,87,245,84,87,245,84,87,245,2325
56 1130 DATA 84,87,245,84,87,245,84,87,245,84,87,245,84,253,245,84,2330
FE 1140 DATA 255,117,84,85,85,80,0,0,0,0,0,0,0,0,0,255,961
13 1150 DATA 0,0,0,0,0,0,1,85,85,1,85,85,1,85,85,1,514
32 1160 DATA 85,85,1,85,85,1,85,85,1,85,85,0,0,0,1,85,769
C8 1170 DATA 85,1,85,85,1,85,85,1,85,85,1,90,85,1,106,149,1030
35 1180 DATA 2,106,149,0,47,149,0,47,128,0,42,128,0,10,0,226,1034
1C 1190 DATA 0,0,0,0,0,0,84,0,0,85,0,0,255,0,0,255,679
8B 1200 DATA 0,0,255,0,0,255,0,0,255,0,0,85,64,0,85,85,1084
D5 1210 DATA 64,85,85,80,85,85,80,85,85,80,85,90,80,85,106,144,1404
3D 1220 DATA 85,106,168,85,101,128,0,37,128,0,42,128,0,10,0,97,1115
F6 1230 DATA 0,0,0,0,0,0,0,0,0,1,85,85,1,85,85,1,343
A6 1240 DATA 85,85,1,85,85,1,85,85,1,85,85,1,85,85,1,85,940
B8 1250 DATA 85,1,85,85,1,85,85,1,85,85,1,85,85,1,85,85,940
6B 1260 DATA 1,85,85,1,85,85,0,0,0,0,0,0,0,0,0,1,343
1E 1270 DATA 0,0,0,0,0,0,0,0,0,85,85,88,247,85,88,87,765
E9 1280 DATA 85,88,87,85,88,87,85,104,87,85,104,87,85,104,87,85,1433
3E 1290 DATA 104,87,85,104,87,85,104,87,85,104,87,85,88,87,85,88,1452
AB 1300 DATA 247,85,88,85,85,88,0,0,0,0,0,0,0,0,0,44,722
B2 1310 DATA 0,0,0,0,0,0,0,0,0,0,0,1,0,0,1,0,2
32 1320 DATA 0,1,0,0,1,0,0,1,0,0,1,0,0,1,85,85,175
B0 1330 DATA 85,85,85,85,85,85,85,85,85,85,86,149,85,90,165,85,1510
48 1340 DATA 26,165,85,11,239,255,11,224,0,10,160,0,2,128,0,225,1541
06 1350 DATA 0,0,0,0,0,0,0,0,0,84,0,0,252,0,0,255,591
98 1360 DATA 0,0,255,0,0,255,192,0,255,192,0,255,240,0,85,85,1814
27 1370 DATA 80,85,85,85,85,85,85,85,85,85,85,86,149,85,90,165,1505
74 1380 DATA 85,90,166,255,249,96,0,9,96,0,10,160,0,2,128,122,1468
67 1390 DATA 0,0,0,0,0,0,0,0,0,85,85,85,106,170,170,119,820
C9 1400 DATA 119,119,93,221,221,119,119,119,93,221,221,119,119,119,93,221,2336
3B 1410 DATA 221,119,119,119,93,221,221,119,119,119,93,221,221,119,119,119,2362
33 1420 DATA 93,221,221,85,85,85,0,0,0,0,0,0,0,0,0,1,791
E9 1430 DATA 0,0,0,0,0,0,0,0,0,85,85,85,127,117,85,125,709
F8 1440 DATA 245,85,87,245,85,87,245,85,87,245,85,87,245,85,87,245,2330
25 1450 DATA 85,87,245,85,87,245,85,87,245,85,87,245,85,125,245,85,2208
7E 1460 DATA 127,117,85,85,85,85,0,0,0,0,0,0,0,0,0,0,584
10 1470 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3D 1480 DATA 0,0,0,0,0,0,0,0.32,0,128,32,0,128,37,85,442
CC 1490 DATA 64,37,85,80,37,85,80,47,255,240,37,105,92,5,170,87,1506
A4 1500 DATA 6,170,149,6,150,149,0,150,0,0,170,0,0,40,0,214,1204
```

```
68  1510 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,32,0,0,32,64
CD  1520 DATA 0,0,32,0,0,32,0,0,
    32,0,0,32,0,0,21,85,234
B7  1530 DATA 64,21,85,64,21,255
    ,240,23,85,80,29,105,80,245,
    170,80,1647
4B  1540 DATA 86,170,168,86,150,
    168,0,150,0,0,170,0,0,40,0,1
    32,1320
23  1550 DATA 0,0,0,0,0,0,0,0,0,0,
    5,85,85,6,233,186,6,606
B1  1560 DATA 233,186,38,233,186
    ,38,233,186,38,233,186,38,23
    3,85,38,233,2417
85  1570 DATA 85,38,233,186,38,2
    33,186,38,233,186,6,233,186,
    6,233,186,2306
41  1580 DATA 6,233,186,5,85,85,
    0,0,0,0,0,0,0,0,0,44,644
05  1590 DATA 0,0,0,0,0,0,0,0,0,0,
    101,85,88,103,255,216,101,94
    9
D8  1600 DATA 85,216,101,85,216,
    101,85,216,101,85,216,101,85
    ,216,101,85,2095
14  1610 DATA 216,101,85,216,101
    ,85,216,101,85,216,101,85,21
    6,101,85,216,2226
75  1620 DATA 103,255,216,101,85
    ,88,0,0,0,0,0,0,0,0,0,0,848
1B  1630 DATA 0,0,0,0,0,0,0,0,0,0,
    2,170,170,10,251,254,11,868
6D  1640 DATA 251,254,43,251,254
    ,43,239,254,175,239,254,175,
    239,254,85,85,3095
E1  1650 DATA 85,85,85,85,85,85,
    85,213,85,85,213,85,85,170,1
    70,170,1871
BA  1660 DATA 90,165,85,27,229,8
    5,11,224,0,10,160,0,2,128,0,
    6,1222
FF  1670 DATA 0,0,0,0,0,0,0,0,0,0,
    168,0,0,252,0,0,255,675
A5  1680 DATA 0,0,255,0,0,255,19
    2,0,255,192,0,255,240,0,85,8
    5,1814
59  1690 DATA 84,85,85,84,85,85,
    85,85,85,85,85,85,85,170,170
    ,149,1592
79  1700 DATA 85,90,166,85,91,22
    4,0,11,224,0,10,160,0,2,128,
    115,1391
80  1710 DATA 0,0,0,0,0,0,0,0,0,0,
    165,85,85,111,239,254,123,10
    62
56  1720 DATA 251,254,126,170,17
    0,126,170,170,126,170,170,12
    6,170,170,126,170,2665
FC  1730 DATA 170,126,170,170,12
    6,170,170,126,170,170,126,17
    0,170,123,251,254,2662
3D  1740 DATA 111,239,254,165,85
    ,85,0,0,0,0,0,0,0,0,0,37,976
58  1750 DATA 0,0,0,0,0,0,0,0,0,0,
    85,85,84,255,117,85,253,964
F7  1760 DATA 245,85,171,245,85,
    171,245,85,171,245,85,171,24
    5,85,171,245,2750
41  1770 DATA 85,171,245,85,171,
    245,85,171,245,85,171,245,85
    ,253,245,85,2672
16  1780 DATA 255,117,85,85,85,8
    4,0,0,0,0,0,0,0,0,0,255,966
44  1790 DATA 0,0,0,0,0,0,0,0,0,0,
    0,21,85,0,175,127,0,408
4E  1800 DATA 191,127,2,191,127,
    2,191,127,10,255,127,10,255,
    127,21,85,1848
91  1810 DATA 85,21,85,85,21,85,
    85,21,85,85,21,105,85,21,170
    ,85,1145
7E  1820 DATA 21,170,85,5,190,85
    ,0,190,0,0,170,0,0,40,0,51,1
    007
27  1830 DATA 0,0,0,0,0,0,0,0,0,0,
    64,0,0,192,0,0,240,496
73  1840 DATA 0,0,240,0,0,252,0,
    0,252,0,0,255,0,0,85,85,1169
47  1850 DATA 64,85,85,80,85,85,
    80,85,85,80,85,105,80,85,170
    ,80,1419
D9  1860 DATA 85,170,64,85,190,0
    ,0,190,0,0,170,0,0,40,0,158,
    1152
4B  1870 DATA 0,0,0,0,0,0,0,0,0,0,
    21,85,85,26,255,127,30,629
F1  1880 DATA 175,127,31,149,85,
    31,149,85,31,149,85,31,149,8
    5,31,149,1542
FC  1890 DATA 85,31,149,85,31,14
    9,85,31,149,85,31,149,85,30,
    175,127,1477
64  1900 DATA 26,255,127,21,85,8
    5,0,0,0,0,0,0,0,0,0,254,853
CA  1910 DATA 0,0,0,0,0,0,0,0,0,0,
    85,85,64,247,85,80,223,869
F3  1920 DATA 85,80,127,85,80,12
    7,85,80,127,85,80,127,85,80,
    127,85,1545
10  1930 DATA 80,127,85,80,127,8
    5,80,127,85,80,127,85,80,223
    ,85,80,1636
B3  1940 DATA 247,85,80,85,85,64
    ,0,0,0,0,0,0,0,0,0,44,690
6C  1950 DATA 0,0,0,0,0,0,0,0,0,0,
    0,1,85,0,5,253,0,344
6D  1960 DATA 5,253,0,23,253,0,2
    3,253,0,95,253,5,95,253,21,8
    5,1617
F2  1970 DATA 85,85,85,85,85,85,
    85,85,85,85,86,149,85,90,165
    ,85,1510
23  1980 DATA 90,165,85,27,229,8
    5,11,224,0,10,160,0,2,128,0,
    204,1420
CB  1990 DATA 0,0,0,0,0,0,0,0,0,0,
    84,0,0,168,0,0,255,507
02  2000 DATA 0,0,255,0,0,255,19
    2,0,255,192,0,255,240,0,85,8
    5,1814
B4  2010 DATA 0,85,85,84,85,85,8
    5,85,85,85,85,86,149,85,90,1
    65,1424
C8  2020 DATA 85,90,166,85,91,22
    4,0,11,224,0,10,160,0,2,128,
    82,1358
1C  2030 DATA 0,0,0,0,0,0,0,0,0,0,
    21,85,85,85,85,255,85,701
C6  2040 DATA 95,127,85,95,213,8
    5,95,213,85,95,213,85,95,213
    ,85,95,1974
65  2050 DATA 213,85,95,213,85,9
    5,213,85,95,213,85,95,213,85
    ,95,127,2092
E2  2060 DATA 85,85,255,21,85,85
    ,0,0,0,0,0,0,0,0,0,254,870
2E  2070 DATA 0,0,0,0,0,0,0,0,0,0,
    85,85,84,255,117,85,253,964
F9  2080 DATA 245,85,87,245,85,8
    7,245,85,87,245,85,87,245,85
    ,87,245,2330
16  2090 DATA 85,87,245,85,87,24
    5,85,87,245,85,87,245,85,253
    ,245,85,2336
1E  2100 DATA 255,117,85,85,85,8
    4,0,0,0,0,0,0,0,0,0,0,711
95  2110 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
B5  2120 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,128,0,85,213
4C  2130 DATA 160,5,85,85,85,85,
    85,85,85,85,85,105,85,255,17
    0,255,1800
0C  2140 DATA 255,170,255,21,190
    ,85,0,190,85,0,170,0,0,40,0,
    33,1494
FD  2150 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
A6  2160 DATA 0,0,48,0,0,48,0,0,
    60,0,0,60,0,0,63,0,279
05  2170 DATA 0,85,80,0,85,85,0,
    85,85,80,85,105,84,255,170,2
    55,1539
E9  2180 DATA 255,170,255,85,190
    ,84,85,190,0,0,170,0,0,40,0,
    172,1696
69  2190 DATA 0,0,0,0,0,0,0,0,0,0,
    21,85,85,85,85,186,85,632
6B  2200 DATA 85,186,85,85,186,8
    5,85,186,85,85,186,85,85,186
    ,85,85,1865
93  2210 DATA 85,85,85,186,85,85
    ,186,85,85,186,85,85,186,85,
    85,186,1865
27  2220 DATA 85,85,186,21,85,85
    ,0,0,0,0,0,0,0,0,0,210,757
DE  2230 DATA 0,0,0,0,0,0,0,0,0,0,
    85,85,84,87,85,85,95,606
29  2240 DATA 85,85,127,85,85,12
    7,85,85,127,85,85,127,85,85,
    127,85,1570
B3  2250 DATA 85,127,85,85,127,8
    5,85,127,85,85,127,85,85,95,
    85,85,1538
01  2260 DATA 87,85,85,85,85,84,
    0,0,0,0,0,0,0,0,0,1,512
75  2270 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
D7  2280 DATA 0,0,0,1,85,0,7,255
    ,0,31,255,64,95,255,21,85,11
    54
55  2290 DATA 255,5,85,85,5,85,8
    5,21,85,85,21,105,85,85,170,
    85,1347
51  2300 DATA 85,170,85,21,190,8
    5,0,190,85,0,170,0,0,40,0,14
    ,1135
5C  2310 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
EA  2320 DATA 0,0,64,0,0,240,0,0
    ,252,0,0,252,0,0,255,0,1063
A9  2330 DATA 0,85,80,0,85,84,0,
    85,85,0,85,105,64,85,170,80,
    1093
0A  2340 DATA 85,170,84,85,190,8
    4,85,190,80,0,170,0,0,40,0,1
    72,1435
C8  2350 DATA 0,0,0,0,0,0,0,0,0,0,
    81,85,85,85,213,255,85,889
BA  2360 DATA 215,255,85,245,85,
    85,245,85,85,245,85,85,245,8
    5,85,245,2460
4D  2370 DATA 85,85,245,85,85,24
    5,85,85,245,85,85,245,85,85,
    215,255,2300
BB  2380 DATA 85,213,255,81,85,8
    5,0,0,0,0,0,0,0,0,0,8,812
4C  2390 DATA 0,0,0,0,0,0,0,0,0,0,
    85,85,80,247,85,84,223,889
1B  2400 DATA 85,84,127,85,84,12
    7,85,84,127,85,84,127,85,84,
    127,85,1565
3F  2410 DATA 84,127,85,84,127,8
    5,84,127,85,84,127,85,84,223
    ,85,84,1660
4E  2420 DATA 247,85,84,85,85,80
    ,0,0,0,0,0,0,0,0,0,254,920
D4  2430 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
C2  2440 DATA 0,0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
17  2450 DATA 0,0,0,0,0,0,5,63,0
    ,85,63,5,85,63,43,213,625
```

```
62  2460 DATA 63,170,245,10,170,
    245,2,170,245,0,170,250,0,40
    ,0,224,2004
3C  2470 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
2A  2480 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0,0,0,0,0,0
65  2490 DATA 0,0,0,0,128,0,0,16
    0,0,0,80,0,0,95,0,0,463
A0  2500 DATA 95,232,0,91,170,64
    ,91,170,80,170,170,84,0,40,0
    ,77,1534
34  2510 DATA 0,0,0,0,0,0,63,170
    ,245,63,170,245,63,170,245,6
    3,1497
91  2520 DATA 40,213,63,37,125,6
    3,165,87,63,169,85,63,170,85
    ,63,169,1660
2E  2530 DATA 85,63,165,87,63,37
    ,125,63,40,213,63,170,245,63
    ,170,245,1897
07  2540 DATA 63,170,245,63,170,
    245,0,0,0,0,0,0,0,0,37,993
71  2550 DATA 0,0,0,0,0,0,92,170
    ,20,92,170,20,92,170,20,95,9
    41
67  2560 DATA 40,20,239,85,84,12
    7,213,84,95,245,84,95,253,84
    ,127,245,2120
50  2570 DATA 84,239,213,84,95,8
    5,84,95,40,20,92,170,20,92,1
    70,20,1603
27  2580 DATA 92,170,20,92,170,2
    0,0,0,0,0,0,0,0,0,0,8,572
49  2590 DATA 0,0,0,0,0,0,0,0,0,
    0,10,170,0,46,254,0,480
4C  2600 DATA 174,254,0,190,254,
    2,190,254,2,190,254,2,170,17
    0,10,170,2286
02  2610 DATA 170,10,170,170,42,
    170,170,42,170,170,42,170,17
    0,42,170,170,2048
64  2620 DATA 10,170,170,2,250,1
    70,2,248,0,2,168,0,0,160,0,2
    7,1379
53  2630 DATA 0,0,0,0,0,0,2,0,0,
    170,0,0,255,0,0,255,682
DC  2640 DATA 0,0,255,192,0,255,
    192,0,255,192,0,170,170,0,17
    0,170,2021
40  2650 DATA 160,170,170,168,17
    0,170,168,170,170,168,170,17
    0,168,170,170,168,2700
F9  2660 DATA 170,170,168,170,17
    5,160,0,47,128,0,42,128,0,10
    ,0,122,1490
DC  2670 DATA 0,0,0,0,0,0,0,0,0,
    10,170,170,42,190,254,42,878
53  2680 DATA 170,170,42,170,170
    ,42,170,170,42,234,170,42,23
    4,170,42,234,2272
F3  2690 DATA 170,42,234,170,42,
    234,170,42,170,170,42,170,17
    0,42,170,170,2208
3D  2700 DATA 42,190,254,10,170,
    170,0,0,0,0,0,0,0,0,222,10
    58
47  2710 DATA 0,0,0,0,0,0,0,0,0,
    170,170,160,254,234,168,170,
    1326
FA  2720 DATA 234,168,170,234,16
    8,170,234,168,170,234,168,17
    0,234,168,170,234,3094
6B  2730 DATA 168,170,234,168,17
    0,234,168,170,234,168,170,23
    4,168,170,234,168,3028
CE  2740 DATA 254,234,168,170,17
    0,160,0,0,0,0,0,0,0,0,0,11
    56
```

PROGRAM: VEHICLES DISPLAY

```
85  10 REM**********************
    ****
31  20 REM* SPRITE LIRBARY DISPL
    AY *
F6  30 REM*         VEHICLES
    *
CB  40 REM**********************
    ****
06  50 POKE55,0:POKE56,40:X=X+1:
    IFX=1THENLOAD"VEHICLES",8,1
5C  60 P0=70:P1=150:P2=118:P3=15
    0:P4=200:P5=150:P6=248:P7=15
    0:S=160:E=199:D=250
2F  70 V=53248:PRINT"[CLS][26CD]
    [9CR][REV]F7 TO STOP ANIMATI
    ON"
96  80 POKEV+21,15:POKEV+23,15:P
    OKEV+28,15:POKEV+29,15:POKEV
    +32,3:POKEV+33,3
63  90 POKEV+37,0:POKEV+38,15:PO
    KEV+39,2:POKEV+40,2:POKEV+41
    ,2:POKEV+42,2:POKEV,P0
B7  100 POKEV+1,P1:POKEV+2,P2:PO
    KEV+3,P3:POKEV+4,P4:POKEV+5,
    P5:POKEV+6,P6:POKEV+7,P7
27  110 INPUT"[HOM][CD]START SPR
    ITE";S:INPUT"END SPRITE";E:I
    NPUT"DELAY";D
A9  120 FORSP=STOESTEP4:FORT=0TO
    D:NEXT:PRINT"[HOM]"TAB(23)"S
    PRITE NO.=";SP:POKE2040,SP
48  130 POKE2041,SP+1:POKE2042,S
    P+2:POKE2043,SP+3:NEXT:GETK$
    :IFK$="[F7]"THEN110
34  140 GOTO120
```

Instructions for entering ROM 80

1) Enter the program 'ROM80.BAS'
2) SAVE this to tape or disk.
   Do NOT RUN it.
3) Enter the following command:
   POKE43,0:POKE44,16:POKE4095,0:NEW
4) Now LOAD and RUN 'ROM80.BAS'
5) When finished enter the following: POKE43,1:POKE44,8:RUN

PROGRAM: ROM80.BAS

```
E4  10 BL=88:LN=50:SA=2049
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
7A  50 DATA 17,8,0,0,158,50,48,5
    5,50,32,171,32,72,67,69,0,82
    9
06  60 DATA 0,0,0,0,0,0,0,162,0,
    160,160,134,247,132,248,160,
    1403
83  70 DATA 224,134,249,132,250,
    162,32,160,0,177,247,145,247
    ,177,249,145,2730
11  80 DATA 249,200,208,245,230,
    248,230,250,202,208,238,162,
    242,160,8,134,3214
B8  90 DATA 247,132,248,160,0,17
    7,247,133,249,32,107,8,177,2
    47,240,33,2437
13  100 DATA 133,250,32,107,8,17
    7,247,72,32,107,8,104,201,98
    ,240,229,2045
68  110 DATA 145,249,230,249,208
    ,239,230,250,208,235,230,247
    ,208,2,230,248,3408
70  120 DATA 96,169,231,133,1,16
    2,0,189,63,13,240,6,32,210,2
    55,232,2032
F5  130 DATA 208,245,32,228,255,
    240,251,201,78,208,8,120,169
    ,229,133,1,2606
82  140 DATA 108,252,255,201,89,
    208,235,120,169,229,133,1,16
    0,0,162,224,2546
43  150 DATA 195,247,134,248,162
    ,85,132,249,70,250,160,55,17
    7,247,145,249,2805
04  160 DATA 32,82,79,77,32,56,4
    8,32,66,89,32,74,133,80,88,1
    89,1189
82  170 DATA 79,13,133,247,189,9
    8,13,240,10,133,248,189,118,
    13,145,247,2115
FD  180 DATA 232,208,236,162,8,3
    2,186,255,169,3,162,66,160,1
    3,32,189,2113
2C  190 DATA 255,162,0,160,32,13
    4,247,132,248,169,247,160,64
    ,32,216,255,2513
8D  200 DATA 96,68,229,169,32,13
    3,219,169,0,160,200,162,8,32
    ,198,230,2105
3B  210 DATA 173,134,2,32,231,23
    0,169,0,133,219,169,0,160,96
    ,162,32,1942
E0  220 DATA 32,198,230,234,234,
    98,108,229,96,164,211,132,22
    1,32,127,229,2575
10  230 DATA 164,221,177,219,96,
    32,111,229,201,32,96,164,214
    ,185,240,236,2617
B6  240 DATA 72,41,240,133,219,1
    04,41,15,9,200,133,220,96,17
    3,33,208,1937
97  250 DATA 77,255,207,41,15,96
    ,98,182,230,230,211,164,211,
    192,80,208,2497
AE  260 DATA 7,160,0,132,211,32,
    42,232,96,133,217,132,218,16
    5,219,160,2156
F0  270 DATA 0,145,217,200,192,2
    50,208,249,152,24,101,217,13
    3,217,144,2,2451
DD  280 DATA 230,218,202,208,232
    ,96,142,134,2,138,10,10,10,1
    0,133,219,1994
4A  290 DATA 173,33,208,41,15,5,
    219,133,219,120,169,225,133,
    1,169,0,1863
ED  300 DATA 76,181,232,0,166,21
    4,208,7,134,211,104,104,76,1
    68,230,202,2313
58  310 DATA 134,214,160,79,132,
    211,96,98,39,231,76,165,231,
    201,13,208,2288
71  320 DATA 3,76,57,232,201,32,
    144,16,201,96,144,4,41,223,2
    08,2,1680
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EA  330 DATA 41,63,32,132,230,76
    ,147,230,166,216,240,3,76,15
    1,230,201,2234
D1  340 DATA 20,208,33,152,208,6
    ,32,1,231,76,105,231,136,132
    ,211,200,1982
7A  350 DATA 32,111,229,136,32,9
    7,233,200,192,79,208,243,169
    ,32,32,97,2122
80  360 DATA 233,76,168,230,166,
    212,240,3,76,151,230,201,18,
    208,2,133,2347
DF  370 DATA 199,201,19,208,3,32
    ,102,229,201,29,208,15,192,7
    9,240,6,1963
3E  380 DATA 200,132,211,76,168,
    230,162,0,76,65,232,201,17,2
    08,3,76,2057
B1  390 DATA 67,232,32,203,232,7
    6,68,236,41,127,201,127,208,
    2,169,94,2115
7C  400 DATA 201,32,144,3,76,145
    ,230,201,13,208,3,76,57,232,
    166,212,1999
E7  410 DATA 208,44,201,20,208,3
    6,160,79,32,111,229,201,32,2
    08,24,196,1989
8C  420 DATA 211,240,20,136,32,1
    11,229,200,32,97,233,136,196
    ,211,208,243,2535
7B  430 DATA 169,32,32,97,233,23
    0,216,76,168,230,166,216,240
    ,5,9,64,2183
37  440 DATA 76,151,230,201,17,2
    08,9,166,214,240,2,198,214,7
    6,168,230,2400
02  450 DATA 201,18,208,4,169,0,
    133,199,201,29,208,15,152,24
    0,6,136,1919
71  460 DATA 132,211,76,168,230,
    32,1,231,76,168,230,201,19,2
    08,6,32,2021
77  470 DATA 68,229,76,168,230,9
    ,128,32,203,232,76,79,236,70
    ,201,166,2203
52  480 DATA 214,232,224,25,208,
    3,32,234,232,134,214,96,162,
    0,134,216,2360
46  490 DATA 134,199,134,212,134
    ,211,32,42,232,76,168,230,16
    9,127,141,0,2241
7E  500 DATA 220,173,1,220,201,2
    51,240,249,162,80,160,200,13
    4,217,132,218,2858
5C  510 DATA 162,0,134,219,132,2
    20,162,8,160,0,177,217,145,2
    19,200,192,2347
2B  520 DATA 240,208,247,24,165,
    217,105,240,133,217,144,2,23
    0,218,24,165,2579
43  530 DATA 219,105,240,133,219
    ,144,2,230,220,202,208,220,1
    62,79,169,32,2584
57  540 DATA 157,128,207,202,16,
    250,162,64,160,97,134,217,13
    2,218,162,0,2306
3C  550 DATA 160,96,134,219,132,
    220,32,223,207,138,157,0,126
    ,157,160,126,2287
0E  560 DATA 232,224,160,208,245
    ,166,214,96,160,92,162,4,32,
    198,230,169,2592
15  570 DATA 229,133,1,88,165,21
    9,141,255,207,96,98,234,232,
    76,73,232,2479
8E  580 DATA 120,169,225,133,1,1
    62,0,160,208,134,217,132,218
    ,160,216,134,2389
4C  590 DATA 219,132,220,160,196
    ,134,221,132,222,162,4,160,0
    ,177,217,32,2388
23  600 DATA 38,233,177,219,32,3
    8,233,165,223,145,221,200,20
    8,239,230,218,2819
61  610 DATA 230,220,230,222,20
    ,208,230,240,14,134,2,162,4,
    10,10,38,2156
E5  620 DATA 223,202,208,249,166
    ,2,96,169,229,133,1,88,162,4
    7,189,231,2395
D5  630 DATA 233,157,208,207,202
    ,16,247,169,224,141,72,196,1
    69,230,141,78,2690
72  640 DATA 196,169,14,141,72,1
    98,169,78,141,78,198,169,204
    ,141,137,197,2302
95  650 DATA 76,33,234,0,133,221
    ,132,222,32,127,229,165,221,
    164,222,145,2356
5B  660 DATA 219,165,220,41,7,9,
    24,133,220,165,222,41,254,24
    ,101,219,2064
16  670 DATA 133,219,144,2,230,2
    20,6,219,38,220,6,219,38,220
    ,165,221,2300
65  680 DATA 9,128,133,217,169,2
    4,133,218,6,217,38,218,6,217
    ,38,218,1989
2E  690 DATA 6,217,38,218,160,0,
    173,24,208,41,2,8,177,217,40
    ,240,1769
1B  700 DATA 4,10,10,10,10,41,24
    0,36,221,16,2,73,240,133,223
    ,165,1434
1F  710 DATA 222,74,176,11,32,20
    8,207,41,15,5,223,145,219,14
    4,17,70,1809
B9  720 DATA 223,70,223,70,223,7
    0,223,32,208,207,41,240,5,22
    3,145,219,2422
95  730 DATA 200,192,8,208,193,1
    65,221,164,222,96,120,169,22
    9,133,1,177,2498
85  740 DATA 219,72,169,229,133,
    1,104,88,96,120,169,229,133,
    1,162,30,1955
72  750 DATA 160,0,177,217,145,2
    19,200,208,249,230,218,230,2
    20,202,208,242,3125
76  760 DATA 169,229,133,1,88,96
    ,168,169,2,133,205,234,234,2
    34,152,164,2411
30  770 DATA 211,76,97,233,169,2
    55,141,189,196,169,153,141,1
    90,196,108,0,2524
2D  780 DATA 160,98,240,236,0,80
    ,160,240,65,145,225,50,130,2
    10,35,115,2189
6E  790 DATA 195,20,100,180,5,85
    ,165,245,70,150,230,55,135,9
    8,125,228,2086
A0  800 DATA 32,82,79,77,32,56,4
    8,32,66,89,32,74,32,80,32,77
    ,920
E8  810 DATA 69,89,69,82,32,32,3
    2,98,6,229,80,98,53,229,11,9
    8,1307
5B  820 DATA 2,230,160,79,132,20
    8,32,121,229,234,98,33,230,2
    34,234,234,2490
6F  830 DATA 98,58,230,32,109,22
    9,234,98,214,232,32,227,230,
    98,68,234,2423
05  840 DATA 32,111,229,234,234,
    98,79,234,32,145,229,240,6,1
    73,134,2,2212
31  850 DATA 32,231,230,98,202,2
    36,187,98,209,236,120,98,217
    ,236,12,15,2457
11  860 DATA 98,255,252,76,237,2
    32,98,136,253,162,0,160,92,9
    8,204,253,2606
B8  870 DATA 6,98,214,253,229,98
    ,157,230,198,216,234,234,234
    ,32,19,234,2686
6E  880 DATA 32,182,230,165,216,
    240,2,70,212,104,168,98,0,0,
    13,69,1801
1B  890 DATA 80,82,79,77,32,40,3
    6,50,48,48,48,41,63,0,239,53
    ,1016
15  900 DATA 115,240,14,248,182,
    189,94,150,158,169,172,204,2
    14,136,137,138,2560
5F  910 DATA 139,40,41,41,41,42,
    38,40,40,37,40,40,40,40,61,6
    1,781
59  920 DATA 61,61,61,61,0,227,2
    31,56,231,231,227,220,231,22
    4,225,224,2571
90  930 DATA 254,254,4,231,152,1
    70,0,0,0,0,0,0,0,0,0,0,1065
```

PROGRAM: BOOT

```
77  10 REM QUESTIONAIRE 1 BOOT
1F  20 POKE53280,0:POKE53281,0:P
    RINTCHR$(144)
1E  30 POKE631,19:POKE632,13:POK
    E633,82:POKE634,117:POKE635,
    13:POKE198,5
A0  40 PROG$="QUESTIONAIRE 1"
5B  50 PRINT"[CLR]L[SO]"+CHR$(34
    )+PROG$+CHR$(34)+",8"
50  60 PRINTCHR$(5)
16  70 PRINT"[RIGHT6,DOWN11]QUES
    TIONAIRE 1 NOW LOADING..."
38  80 PRINTCHR$(144)
```

PROGRAM: QUESTIONAIRE 1

```
53  10 POKE808,251:REM DISABLE S
    TOP KEY
37  20 POKE774,226:POKE775,252:R
    EM LIST COLD START
D9  30 POKE53280,2:POKE53281,0:P
    RINT"[CLR]"
A1  40 IFPEEK(49152)=120THENGOTO
    90
4A  50 IFPEEK(49152)<>120THENT=0
    :FORI=49152TO49298:READA:T=T
    +A:POKEI,A:NEXT
02  60 IFT<>17877THENPRINT"DATA
    WRONG":END
75  70 FORI=0TO24:READA:POKE4929
    9+I,A:NEXTI
C5  80 FORI=0TO447:READA:POKE159
    36+I,A:NEXTI
A4  90 A$="[SPC7]** **  * *****
     **  *  **":GOSUB220
38  100 A$="[SPC8]** **   **[SPC4
    ]*  *  **   * ":GOSUB220
10  110 A$="[SPC9]*   **   **[SPC3
    ]*  **  ** **":GOSUB220
FC  120 A$="[SPC9]*[SPC3]**   *
    *  *** *** **":GOSUB220
8C  130 A$="[SPC9]*[SPC3]**   *[S
    PC3]*  **********":GOSUB220
F6  140 A$="[SPC8]**[SPC3]*   **[
    SPC3]*  ** **  **":GOSUB220
8C  150 A$="[SPC7]******  ******
```

```
      **  *  **":GOSUB220
03  160 PRINT"[DOWN,YELLOW]"TAB(
    7)"***************************
    *"
D4  170 A$="[SPC7,RVSON]********
    *PRESENTS*********":GOSUB220
D6  180 PRINT"[YELLOW]"TAB(7)"**
    *************************"
BD  190 POKE198,0:FORI=0TO6::PRI
    NT:NEXTI:PRINT"[SPC6]<<PRESS
     A KEY TO CONTINUE>>"
87  200 GETA$:IFA$=""THEN200
EE  210 GOTO230
D8  220 FORT=1TOLEN(A$):PRINT"[W
    HITE]"MID$(A$,T,1);:FORT1=1T
    O2:NEXTT1,T:PRINT:RETURN
70  230 POKE53280,5:POKE53281,0
6E  240 PRINT"[CLR,DOWN2,RED] [C
    @38]"
BD  250 PRINTTAB(1)"[BLUE]*[SS]*
    [SS]*[SS]*[SS]*[SS]*[SS]*[SS
    ]*[SS]*[SS]*[SS]**[SS]*[SS]*
    [SS]*[SS]*[SS]*[SS]*[SS]*[SS
    ]*"
EE  260 PRINT"[RED] [CT38]"
38  270 PRINT"[DOWN6,RED] [C@38]
    "
68  280 PRINTTAB(1)"[BLUE]*[SS]*
    [SS]*[SS]*[SS]*[SS]*[SS]*[SS
    ]*[SS]*[SS]*[SS]**[SS]*[SS]*
    [SS]*[SS]*[SS]*[SS]*[SS]*[SS
    ]*"
0C  290 PRINT"[RED] [CT38]"
E1  300 PRINTTAB(10)"[RED,DOWN3,
    CP21]"
FF  310 PRINTTAB(10)"[RVSON,YELL
    OW,SPC3]D.WARNER[SPC3]1987[S
    PC3]"
52  320 PRINTTAB(10)"[RED,CY21]"
76  330 PRINTTAB(7)"[DOWN,CYAN,S
    PC3]PRESS 'C' TO CONTINUE":P
    OKE198,0
2E  340 POKE53280,0:POKE53281,0:
    PRINTCHR$(5):SD=249
3E  350 POKE53269,255:REM TURN O
    N 8 SPRITES
BA  360 FORSP=2040TO2046:POKESP,
    SD:SD=SD+1:NEXTSP:REM SPRITE
     POINTERS
FC  370 FORC=53287TO53294:POKEC,
    0:NEXTC:REM SPRITE COLOUR
7C  380 POKE53277,255:POKE53271,
    255:REM EXPAND 8 SPRITES
CE  390 POKE53248,45:POKE53249,9
    3: REMSPR0 XY
B1  400 POKE53250,78:POKE53251,9
    3: REMSPR1 XY
9E  410 POKE53252,126:POKE53253,
    93:REMSPR2 XY
A4  420 POKE53254,174:POKE53255,
    93:REMSPR3 XY
57  430 POKE53256,222:POKE53257,
    93:REMSPR4 XY
CF  440 POKE53264,96:REM MSB SPR
    5 & SPR6
71  450 POKE53258,14:POKE53259,9
    3:REMSPR5 XY
ED  460 POKE53260,37:POKE53261,9
    3:REMSPR6 XY
01  470 POKE820,11:SYS49299:GOSU
    B580:REM SPRITE COLOUR
63  480 POKE820,11:SYS49299:GOSU
    B580:REM SPRITE COLOUR
BE  490 POKE820,12:SYS49299:GOSU
    B580:REM SPRITE COLOUR
D3  500 POKE820,15:SYS49299:GOSU
    B580:REM SPRITE COLOUR
08  510 POKE820,7:SYS49299:GOSUB
    580:REM SPRITE COLOUR
93  520 POKE820,1:SYS49299:GOSUB
    580:REM SPRITE COLOUR
33  530 POKE820,7:SYS49299:GOSUB
    580:REM SPRITE COLOUR
1A  540 POKE820,15:SYS49299:GOSU
    B580:REM SPRITE COLOUR
8B  550 POKE820,12:SYS49299:GOSU
    B580:REM SPRITE COLOUR
69  560 GETA$:IFA$="C"THENPOKE53
    269,0:GOTO590
51  570 IFA$<>"C"THEN470
AC  580 FORI=0TO40:NEXTI:RETURN:
    REM TIME DELAY
81  590 PRINT"[CLR]":POKE53280,0
    :POKE53281,0:PRINTCHR$(5)
EC  600 POKE198,0:PRINT:INPUT"[W
    HITE,DOWN]DO YOU WANT A CLOC
    K ON SCREEN[RIGHT2,CB,LEFT3]
    ";Z$
06  610 IFZ$<>"Y"THEN740
CF  620 PRINT"[CLR]ENTER TIME(A/
    P.HR.MN.SE)";:INPUT"[WHITE,R
    IGHT2,CB,LEFT3]";A$:IFLEN(A$
    )<10THEN620
B2  630 H$="A":IFLEFT$(A$,1)="P"
    THENH$="P"
6D  640 HO=1:HU=VAL(MID$(A$,3,2)
    ):IFHU>0ANDHU<13THENHO=HU
6C  650 MI=1:MA=VAL(MID$(A$,6,2)
    ):IFMA>0ANDMA<60THENMI=MA
C4  660 SE=1:SE=VAL(MID$(A$,9,2)
    ):IFS>0ANDS<60THENSE=S
D7  670 IFHO>9THENHO=HO+6
B9  680 IFMI>9THENMI=INT(MI/10)*
    16+MI-INT(MI/10)*10
1D  690 IFSE>9THENSE=INT(SE/10)*
    16+SE-INT(SE/10)*10
21  700 IF H$="P"THENHO=HO+128
11  710 POKE56331,HO:POKE56330,M
    I:POKE56329,SE:POKE56328,0
39  720 POKE821,13:SYS49152:GOTO
    740
48  730 POKE631,VA:POKE198,1
73  740 CLR:GOSUB910
8D  750 IFFLAG=1THEN770
FE  760 GOSUB1150
8D  770 GOSUB1400
8D  780 GOSUB1460
FE  790 POKE53280,8:POKE53281,8
D5  800 IFSC=XTHENGOSUB2300
05  810 PRINT"[CLR,DOWN2]FROM A
    POSSIBLE TOTAL OF ";X;"QUEST
    IONS"
AC  820 PRINT:PRINT"[SPC7]YOU HA
    D ";SC;" CORRECT ANSWERS"
D1  830 PRINT:PRINT"[SPC7]OR ";(
    SC/1)*(1/X)*(100/1);"%"
CD  840 POKE198,0:PRINT:PRINT"[S
    PC7]<<PRESS A KEY TO CONTINU
    E>>"
0D  850 GETA$:IFA$=""THEN850
6E  860 GOTO910
A3  870 PRINT"[CLR]"
EF  880 CLR
29  890 DIMQ$(X):DIMA$(X),B$(X),
    C$(X),D$(X)
91  900 DIMR(X):DIMR$(X):RETURN
AC  910 PRINT"[CLR,WHITE]":POKES
    3281,2:POKE53280,0:PRINT"[SP
    C15,C@9]"
EA  920 PRINT"[SPC15,RVSON]MAIN
    MENU[RVSOFF]"
22  930 PRINT:PRINT"[SPC11]1. EN
    TER NEW DATA"
13  940 PRINT:PRINT"[SPC11]2. LO
    AD QUESTION FILE"
9D  950 PRINT:PRINT"[SPC11]3. SA
    VE QUESTION FILE"
12  960 PRINT:PRINT"[SPC11]4. DI
    SK UTILITIES"
B8  970 PRINT:PRINT"[SPC11]5. RU
    N QUESTIONS"
F8  980 PRINT:PRINT"[SPC11]6. QU
    IT FOR GOOD"
F4  990 GETA$:IFA$=""THEN990
29  1000 IFA$="1"AND EN=1THENVA=
    49:GOTO730
FD  1010 IFA$="1"ANDLO=1THENVA=4
    9:GOTO730
57  1020 IFA$="1"THENGOSUB760
FC  1030 IFA$="2"AND SA=1THENVA=
    50:GOTO730
A5  1040 IFA$="2"ANDLO=1THENVA=5
    0:GOTO730
39  1050 IFA$="2"ANDEN=1THENVA=5
    0:GOTO730
12  1060 IFA$="2"THENGOSUB1830:G
    OSUB1780:FLAG=1:RETURN
D7  1070 IFA$="3"ANDQ=0THENPRINT
    "[CLR]THERE ARE NONE TO SAVE
    !":FORI=0TO1000:NEXT:GOTO910
7C  1080 IFA$="3"THENSA=1:GOSUB1
    690
A8  1090 IFA$="4"THENGOSUB2390
4F  1100 IFA$="5"ANDRU=0THENPRIN
    T"[CLR]THERE ARE NONE TO RUN
    !":FORI=0TO1000:NEXT:GOTO910
8A  1110 IFA$="5"AND RU=1 THEN78
    0
43  1120 IFA$="6"THEN1940
8F  1130 IFA$<>"N"THEN990
F6  1140 RETURN
99  1150 GOSUB1900
82  1160 POKE53280,6:POKE53281,9
15  1170 FORC=1TOX
EC  1180 PRINT"[CLR]":PRINT:PRIN
    T
2E  1190 PRINT"PLEASE ENTER QUES
    TION NO";C
25  1200 PRINT:INPUT"[WHITE,RIGH
    T2,CB,LEFT3]";I$
37  1210 PRINT:PRINT"[SPC5]IS TH
    IS QUESTION OK? Y/N"
36  1220 GETY$:IFY$=""THEN1220
C9  1230 IFY$="N"THEN1180
C9  1240 IFY$<>"Y"THEN1220
BC  1250 Q$(C)=I$
53  1260 PRINT"[CLR,DOWN]PLEASE
    INPUT THE MULTIPLE ANSWERS T
    O[SPC4]QUESTION NO:";C
FD  1270 PRINT:PRINT"Q. ";:P$=Q$
    (C):GOSUB1640
55  1280 PRINT"[HOME,DOWN6]":PRI
    NT"ANSWERS:-":PRINT
90  1290 INPUT"[WHITE]A.[RIGHT2,
    CB,LEFT3]";I$:A$(C)=I$
71  1300 PRINT:INPUT"[WHITE]B.[R
    IGHT2,CB,LEFT3]";I$:B$(C)=I$
97  1310 PRINT:INPUT"[WHITE]C.[R
    IGHT2,CB,LEFT3]";I$:C$(C)=I$
7D  1320 PRINT:INPUT"[WHITE]D.[R
    IGHT2,CB,LEFT3]";I$:D$(C)=I$
E4  1330 PRINT:PRINT:INPUT"[WHIT
    E]ENTER THE CORRECT ANSWER A
    ,B,C,D.[RIGHT2,CB,LEFT3]";I$
57  1340 IFASC(I$)<65ORASC(I$)>6
    8THENPRINT"[UP]";:GOTO1330
D5  1350 R$(C)=I$:PRINT:PRINT:PR
    INT"[SPC5]<<PRESS ANY KEY TO
     CONTINUE>>"
38  1360 GETA$:IFA$=""THEN1360
20  1370 NEXTC
5D  1380 Q=1:EN=1
FD  1390 RETURN
CF  1400 FORC=1TOX:R(P)=0:NEXTC:
    FORC=1TOX
86  1410 P=INT(RND(0)*X)+1
D4  1420 IFR(P)<>0THEN1410
```

```
BB  1430 R(P)=C
6A  1440 NEXTC
21  1450 RETURN
F5  1460 SC=0:RU=1
BF  1470 POKE53280,6:POKE53281,9
6B  1480 FORC=1TOX:PRINT"[CLR]":
    PRINT"QUESTION NO.";C:PRINT:
    P$=Q$(R(C)):GOSUB1640
55  1490 PRINT:PRINT:PRINT:PRINT
    "A. ";:P$=A$(R(C)):GOSUB1640
BD  1500 PRINT:PRINT"B. ";:P$=B$
    (R(C)):GOSUB1640
1D  1510 PRINT:PRINT"C. ";:P$=C$
    (R(C)):GOSUB1640
ED  1520 PRINT:PRINT"D. ";:P$=D$
    (R(C)):GOSUB1640
59  1530 PRINT:PRINT:PRINT:INPUT
    "[WHITE,DOWN]ENTER A,B,C,D.[
    RIGHT2,CB,LEFT3]";I$
3E  1540 IFASC(I$)<65ORASC(I$)>6
    8THENPRINT"[UP]";:GOTO1530
2A  1550 IFR$(R(C))=I$THENPRINT:
    PRINTSPC(15)I$;" IS CORRECT"
    :SC=SC+1:Q=8:GOSUB2110
94  1560 IFR$(R(C))=I$THENGOTO16
    00
BE  1570 PRINT:PRINTSPC(15)I$;"
    IS WRONG"
1D  1580 PRINTSPC(15)R$(R(C));"
    IS THE CORRECT ANSWER"
6C  1590 Q=4:GOSUB2110
33  1600 PRINT:PRINT"[SPC9]<<ANY
    KEY TO CONTINUE>>"
49  1610 GETA$:IFA$=""THEN1610
1B  1620 NEXTC
EA  1630 RETURN
E6  1640 IFLEN(P$)>80THEN1660
37  1650 FORN=1TOLEN(P$):PRINTMI
    D$(P$,N,1);:NEXTN:PRINT:RETU
    RN
B7  1660 N1=80
54  1670 IFMID$(P$,N1,1)<>" "THE
    N N1=N1-1:GOTO1670
02  1680 FORN=NTON1:PRINTMID$(P$
    ,N,1);:NEXTN:PRINT:P$=MID$(P
    $,N1+1):GOTO1640
40  1690 PRINT"[CLR,DOWN2]":INPU
    T"[WHITE,DOWN]ENTER FILENAME
    :[RIGHT2,CB,LEFT3]";I$
2A  1700 PRINT"[CLR]":PRINT"[SPC
    7]PLACE FILES DISK INTO DRIV
    E"
D3  1710 PRINT:PRINT"[SPC7]<<PRE
    SS SPACE TO CONTINUE>>"
39  1720 GETA$:IFA$=""THEN1720
72  1730 OPEN1,8,1,I$
54  1740 FORC=1TOX:PRINT#1,Q$(C)
    :PRINT#1,A$(C):PRINT#1,B$(C)
    :PRINT#1,C$(C)
FC  1750 PRINT#1,D$(C):PRINT#1,R
    $(C):NEXTC:CLOSE1
56  1760 IFSA=1THENSA=0:GOTO910
7E  1770 RETURN
3F  1780 PRINT:INPUT"[WHITE,DOWN
    ]ENTER FILENAME:[RIGHT2,CB,L
    EFT3]";I$
22  1790 OPEN1,8,0,I$:PRINT"[CLR
    ]":PRINT:PRINT"[SPC7]";I$;"
    IS NOW LOADING"
AD  1800 FORC=1TOX:INPUT#1,Q$(C)
    :INPUT#1,A$(C):INPUT#1,B$(C)
    :INPUT#1,C$(C)
D9  1810 INPUT#1,D$(C):INPUT#1,R
    $(C):NEXTC:CLOSE1
95  1820 LO=1:RETURN
3C  1830 PRINT"[CLR]":POKE53280,
    0:POKE53281,0:PRINTCHR$(5)
39  1840 GOSUB2500
DB  1850 PRINT
A8  1860 PRINT"[SPC6]PRESS D. TO
    VIEW DIRECTORY OF[SPC11]THI
    S OR ANOTHER DISK"
CF  1870 PRINT:PRINT"[SPC6]PRESS
     ANY KEY TO LOAD A FILE"
C7  1880 GETA$:IFA$=""THEN1880
29  1890 IFA$="D"THEN1840
82  1900 PRINT:INPUT"[WHITE,DOWN
    ,SPC6]HOW MANY QUESTIONS[RIG
    HT2,CB,LEFT3]";X
95  1910 IFX<=0THEN740
AB  1920 GOSUB890
1F  1930 RETURN
D9  1940 PRINT"[CLR]"
E0  1950 POKE53280,0:POKE53281,0
    :PRINTCHR$(5)
B7  1960 PRINT"[DOWN2] I WILL SE
    LF-DESTRUCT IN[SPC4]SECONDS!
    !":TI$="000000"
B2  1970 PRINTTAB(24)"[UP]"10-VA
    L(TI$)"[LEFT] ":IFVAL(TI$)<1
    0THEN1980
48  1980 PRINTTAB(24)"[UP]"10-VA
    L(TI$)"[LEFT] ":IFVAL(TI$)<1
    0THEN1980
9C  1990 PRINT"[CLR]":FORX=1TO10
    0
F9  2000 POKE53280,2:POKE53281,4
    :POKE53280,8
CD  2010 POKE53281,3:POKE53280,7
    :POKE53281,9
C1  2020 NEXTX
ED  2030 PRINT"[DOWN11,RIGHT18,C
    @5]"
2F  2040 PRINT"[SPC18,RVSON]BANG
    !"
1A  2050 POKE54296,15:POKE54278,
    240
41  2060 FORI=1TO80
A6  2070 POKE54276,17:POKE54273,
    99+100*RND(0)
33  2080 NEXT:POKE54276,0
50  2090 FORT=1TO2000:NEXTT
62  2100 PRINT"[CLR]":SYS64738
FD  2110 S=54272:W(1)=17:W(2)=33
    :W(3)=129
92  2120 FORZ=STOS+24:POKEZ,0:NE
    XTZ
10  2130 P=Q:W=2
6C  2140 POKES+24,15:POKES+5,15:
    POKES+4,W(W):POKES+6,15
11  2150 ONPGOSUB2170,2180,2190,
    2200,2210,2220,2230,2240,225
    0,2260,2270
85  2160 POKES+4,W(W)-1:POKES+5,
    0:POKES,0:POKES+1,0:RETURN
17  2170 FORZ=1TO75STEP.1:POKES+
    1,Z:NEXTZ:RETURN
F1  2180 FORZ=1TO75STEP.1:POKES+
    1,Z:POKES,Z:NEXTZ:RETURN
50  2190 FORZ=75TO5STEP-1:POKES+
    1,Z:POKES,Z:NEXTZ:RETURN
7D  2200 FORZ=1TO100:POKES+1,RND
    (1)*75:NEXTZ:RETURN
70  2210 FORZ=1TO200:POKES+1,ABS
    (TAN(Z)+5):NEXTZ:RETURN
46  2220 POKES+1,10:POKES,127:FO
    RZ=1TO15STEP.05:POKES+24,Z:N
    EXTZ:RETURN
38  2230 FORZ=1TO250STEP1:POKES+
    1,Z:POKES+1,255-Z:NEXTZ:RETU
    RN
77  2240 FORZ=5TO100STEP5:FORZZ=
    10TO100STEP10:POKES+1,Z:POKE
    S,ZZ:NEXTZZ,Z:RETURN
C9  2250 FORZ=20TO200STEP10:FORZ
    Z=1TO20:POKES+1,Z-ZZ:POKES+1
    ,ZZ+50:NEXTZZ,Z:RETURN
2B  2260 FORZ=1TO40:FORZZ=1TORND
    (1)*50:POKES+1,ZZ:NEXTZZ,Z:R
    ETURN
8B  2270 FORZ=10TO100STEP10:FORZ
    Z=5TOZ:POKES+1,Z-ZZ:NEXTZZ,Z
    :RETURN
D2  2280 POKES+1,RND(1)*200+5:FO
    RZ=1TORND(1)*500+100:NEXTZ:R
    ETURN
D4  2290 POKES+1,RND(1)*200+5:FO
    RZ=1TORND(1)*100STEP.2:POKES
    +24,Z:NEXTZ:RETURN
17  2300 POKE53280,0:POKE53281,0
    :PRINTCHR$(5):PRINT"[CLR]"
1B  2310 FORI=1TO9:PRINT:NEXTI
70  2320 PRINT"[SPC12]CONGRATULA
    TIONS!!":PRINT
D0  2330 PRINT"[SPC17]YOU GOT[SP
    C6]":PRINT
75  2340 PRINT"[SPC10]ONE HUNDRE
    D PERCENT!!"
68  2350 Q=7:GOSUB2110
30  2360 GOSUB2110
72  2370 FORI=1TO400:NEXT
DB  2380 RETURN
92  2390 PRINT"[CLR]":POKE53280,
    0:POKE53281,0:PRINTCHR$(5)
CF  2400 PRINT"[SPC11]DISK UTILI
    TIES"
68  2410 PRINT:PRINT"[SPC11]1. V
    IEW DIRECTORY"
A5  2420 PRINT:PRINT"[SPC11]2. S
    CRATCH FILE"
EB  2430 PRINT:PRINT"[SPC11]3. V
    ALIDATE DISK"
E3  2440 PRINT:PRINT"[SPC11]4. F
    ORMAT DISK"
D3  2450 PRINT:PRINT"[SPC11]5. R
    EAD ERROR CHANNEL"
C9  2460 PRINT:PRINT"[SPC11]6. Q
    UIT TO MAIN MENU"
60  2470 PRINT:INPUT"[WHITE,DOWN
    ,SPC11]ENTER CHOICE[RIGHT2,C
    B,LEFT3]";A
EA  2480 ONAGOSUB2500,2630,2730,
    2900,3110,910
B8  2490 GOTO2390
D3  2500 PRINT"[CLR]":PRINT:PRIN
    T"[SPC10]PLACE DISK INTO DRI
    VE"
38  2510 PRINT:PRINT"[SPC7]<<PRE
    SS A KEY TO CONTINUE>>"
C5  2520 GETA$:IFA$=""THEN2520
43  2530 PRINT"[CLR]":OPEN1,8,0,
    "$"
75  2540 GET#1,B$:IFST<>0THEN259
    0
3F  2550 IFB$<>CHR$(34)THEN2540
44  2560 PRINTTAB(14):GET#1,B$:I
    FB$<>CHR$(34)THENPRINTB$;:GO
    TO2560
4C  2570 PRINTLEFT$(C$,3)
88  2580 IFST=0THEN2540
B9  2590 CLOSE1
DB  2600 PRINT:PRINT"[SPC7]<<PRE
    SS A KEY TO CONTINUE>>"
36  2610 GETA$:IFA$=""THEN2610
C8  2620 RETURN
CB  2630 PRINT"[CLR,SPC14]FILE D
    ELETE"
05  2640 PRINT:INPUT"[WHITE,DOWN
    ,SPC14]SURE Y/N[RIGHT2,CB,LE
    FT3]";A$
4E  2650 IFA$<>"Y"THEN2390
91  2660 A$="XX"
E8  2670 PRINT:PRINT"[SPC14]NAME
     TO":INPUT"[WHITE,DOWN,SPC14
    ]DELETE[RIGHT2,CB,LEFT3]";A$
8F  2680 IFA$="XX"THEN2390
30  2690 IFA$<>"XX"THENPRINT"[SP
    C14]DELETING ";A$
6E  2700 IFA$<>"XX"THENOPEN15,8,
    15
72  2710 PRINT#15,"S:";A$;""
C6  2720 CLOSE15:RETURN
```

```
C9  2730 PRINT"[CLR]":PRINT"[SPC
         16]VAL. DISK"
08  2740 PRINT:PRINT"[SPC10]PLAC
         E DISK INTO DRIVE"
BD  2750 PRINT:PRINT"[SPC7]<<PRE
         SS A KEY TO CONTINUE>>"
A0  2760 GETA$:IFA$=""THEN2760
E5  2770 OPEN15,8,15
54  2780 PRINT"[CLR]"
B4  2790 FORI=1TO12:PRINT:NEXTI
9D  2800 PRINT"[SPC13]VALIDATING
          DISK"
7E  2810 PRINT#15,"V"
D5  2820 CLOSE15
53  2830 PRINT"[CLR]"
43  2840 FORI=1TO12:PRINT:NEXTI
56  2850 POKE198,0
79  2860 PRINT"[CLR]":PRINT"[SPC
         12]DISK VALIDATED"
40  2870 PRINT:PRINT"[SPC6]<<PRE
         SS A KEY TO CONTINUE>>"
CE  2880 GETA$:IF A$=""THEN2880
DB  2890 RETURN
9D  2900 PRINT"[CLR]"
8E  2910 POKE53280,0:POKE53281,0

E7  2920 PRINTCHR$(5)
18  2930 PRINT"[SPC14]FORMAT DIS
         K"
FB  2940 PRINT:INPUT"[SPC14]SURE
         ? Y/N";A$
67  2950 IFA$="Y"THEN2970
2F  2960 IFA$<>"Y"THEN2390
7E  2970 PRINT:INPUT"[SPC14]DISK
          NAME";N$
D6  2980 PRINT:INPUT"[SPC14]ID";
         I$
08  2990 OPEN15,8,15
DC  3000 PRINT#15,"N:"N$","I$""
07  3010 PRINT"[CLR]"
CF  3020 FORI=1TO12:PRINT:NEXTI
29  3030 PRINT"[SPC8]FORMATTING
         DISK " N$ " " I$""
49  3040 CLOSE15
3F  3050 PRINT"[CLR]"
D3  3060 PRINT"[SPC12]DISK " N$
         " " I$" READY"
85  3070 PRINT:PRINT"[SPC12]ANOT
         HER DISK Y/N"
E4  3080 GETA$:IFA$=""THEN3080
AD  3090 IFA$="Y"THENGOTO2970
E2  3100 IFA$<>"Y"THEN2390
64  3110 PRINT"[CLR]":FORI=0TO4:
         PRINT:NEXTI
84  3120 PRINTTAB(14)
91  3130 OPEN2,8,15
5F  3140 GET#2,A$:PRINTA$;:IF A$
         <>CHR$(13)GOTO3140
2C  3150 CLOSE2
59  3160 PRINT:PRINT"[SPC7]<<PRE
         SS A KEY TO CONTINUE>>"
00  3170 GETA$:IF A$=""THEN3170
F6  3180 RETURN
8F  3190 DATA120,169,21,141,20,3
         ,169,192,141,21
23  3200 DATA3,173,14,220,9,128,
         141,14,220,88
7B  3210 DATA96,230,171,165,171,
         201,60,144,79,169
26  3220 DATA26,133,167,169,4,13
         3,168,24,169,0
87  3230 DATA101,167,133,169,169
         ,212,101,168,133,170
D4  3240 DATA173,11,220,72,160,1
         29,41,128,240,2
75  3250 DATA160,144,152,160,0,1
         45,167,32,129,192
AE  3260 DATA32,134,192,104,41,1
         27,32,111,192,169
CA  3270 DATA58,145,167,32,129,1
         92,173,10,220,32
33  3280 DATA111,192,169,58,145,
         167,32,129,192,173
C1  3290 DATA9,220,32,111,192,17
         3,8,220,76,49
0C  3300 DATA234,72,41,240,74,74
         ,74,74,32,124
44  3310 DATA192,104,41,15,24,10
         5,176,145,167,173
7B  3320 DATA53,3,145,169,230,16
         7,208,2,230,168
AD  3330 DATA230,169,208,2,230,1
         70,96
6B  3340 DATA173,52,3,141,39,208
         ,141,40,208,141,41,208,141,4
         2,208,141,43,208
A2  3350 DATA141,44,208,141,45,2
         08,96
CC  3360 DATA255,255,255,192,0,0
         ,192,0,0,192,0,0,192,0,0,192
         ,0,0,192,0,0,192
44  3370 DATA0,0,192,0,0,192,0,0
         ,192,0,0,192,0,0,192,0,0,192
         ,0,0
D2  3380 DATA192,0,0,192,0,0,192
         ,0,0,192,0,0,192,0,0,192,0,0
         ,255,255,255,255
0C  3390 DATA255,255,255,0,0,0,0
         ,0,0,0,30,192,0,126,224,0
6C  3400 DATA231,240,0,198,112,1
         ,198,120,1,222,56,1,206,119,
         1,207
70  3410 DATA119,0,219,227,0,241
         ,235,0,127,251,0,31,121,0,0,
         16
E2  3420 DATA0,0,0,0,0,0,0,0,0,0
         ,0,0,255,255,255,0
D0  3430 DATA255,255,255,0,0,0,0
         ,0,0,0,0,0,0,0,0,0
41  3440 DATA0,0,0,0,96,0,0,48,0
         ,0,48,113,198,49,55,239
E6  3450 DATA188,55,109,60,55,19
         8,48,243,169,48,153,239,56,0
         ,2,8
7A  3460 DATA0,0,0,0,0,0,0,0,0,0
         ,0,0,255,255,255,0
08  3470 DATA255,255,255,0,0,0,0
         ,0,0,0,0,0,0,0,0,0
B8  3480 DATA0,0,0,0,0,0,0,0,0,0
         ,0,128,0,0,7,44
55  3490 DATA28,207,191,50,204,1
         79,54,205,179,54,207,153,155
         ,2,0,0
12  3500 DATA0,0,0,0,0,0,0,0,0,0
         ,0,0,255,255,255,0
40  3510 DATA255,255,255,0,0,0,0
         ,0,0,0,0,0,0,0,0,0
D5  3520 DATA0,1,0,0,3,0,0,0,0,0
         ,0,192,0,0,13,142
C1  3530 DATA0,102,223,0,102,27,
         0,102,30,0,99,29,128,1,7,3
6A  3540 DATA0,0,0,0,0,0,0,0,0,0
         ,0,0,255,255,255,0
96  3550 DATA255,255,255,0,0,0,0
         ,0,0,112,0,0,240,0,0,240
4C  3560 DATA0,0,112,0,0,112,0,0
         ,112,0,0,112,0,0,112,0
05  3570 DATA0,112,0,0,112,0,0,1
         12,0,0,248,0,0,252,0,0
82  3580 DATA0,0,0,0,0,0,0,0,0,0
         ,0,0,255,255,255,0
0B  3590 DATA255,255,0,0,3,0,0,3
         ,0,0,3,0,0,3,0,0
8B  3600 DATA3,0,0,3,0,0,3,0,0,3
         ,0,0,3,0,0,3
DE  3610 DATA0,0,3,0,0,3,0,0,3,0
         ,0,3,0,0,3,0
C5  3620 DATA0,3,0,0,3,0,0,3,0,0
         ,3,0,255,255,0,0
```

PROGRAM: LISTING 1

```
   10                        .ORG    $C
000
   20 CIAIRQMASK        =$DC0D
   30 CIAIRQREG         =$DD0D
   40 VICCTRL           =$D011
   50 RASCOMPARE        =$D012
   60 RASTER1           =$0A
   70 RASTER2           =$9E
   80 YELLOW            =$07
   90 BLACK             =$00
  100 BORDER            =$D020
  110 SCREEN            =$D021
  120 LO.VECTOR         =$0314
  130 HI.VECTOR         =$0315
  140 VICIRQ            =$D019
  150 IRQMASK           =$D01A
  160 INITIALISE         SEI
  170                    ;DISABLE I
RQ
  180                    LDA #$1F
  190                    STA CIAIRQ
MASK
  200                    STA CIAIRQ
REG
  210                    ;ENABLE IR
Q
  220                    LDA CIAIRQ
MASK
  230                    LDA CIAIRQ
REG
  240                    LDA VICCTR
L
  250                    AND #$7F
  260                    STA VICCTR
L
  270                    ;CHANGE $0
314 VECTOR TO ROUTINE 1
  280 SETPOINT           LDA #ROUTI
NE1&255
  290                    STA LO.VEC
TOR
  300                    LDA #ROUTI
NE1/256
  310                    STA HI.VEC
TOR
  320                    ;ENABLE IR
Q
  330                    LDA #$01
  340                    STA IRQMAS
K
  350                    ;SET RASTE
R INTERRUPT CONTROL TO FIRST SPL
IT
  360 RASTERUPT          LDA #RASTE
R1
  370                    STA RASCOM
PARE
  380                    ;RETURN TO
 BASIC
  390                    CLI
  400                    RTS
  410                    ;
  420                    ;
  430                    ;SET COLOU
R TO YELLOW
  440 ROUTINE1           LDA #YELLO
W
  450                    STA BORDER
  460                    STA SCREEN
  470                    ;SET INTER
RUPT VECTORS FOR SECOND SPLIT
  480                    LDA #ROUTI
NE2&255
  490                    STA LO.VEC
TOR
  500                    LDA #ROUTI
```

```
NE2/256
  510                     STA HI.VEC
TOR
  520                     LDA #RASTE
R2
  530                     STA RASCOM
PARE
  540                     LDA #$01
  550                     STA VICIRQ
  560                     JMP $EA31
  570                     ;
  580                     ;
  590                     ;NOP PAD M
AY NEED INCREASE/DECREASE FOR YO
UR MACHINE
  600 ROUTINE2            NOP
  610                     NOP
  620                     NOP
  630                     NOP
  640                     NOP
  650                     NOP
  660                     NOP
  670                     NOP
  680                     NOP
  690                     ;CHANGE CO
LOUR TO BLACK
  700                     LDA #BLACK
  710                     STA BORDER
  720                     STA SCREEN
  730                     ;SET UP VE
CTORS FOR ROUTINE 1
  740                     LDA #ROUTI
NE1&255
  750                     STA LO.VEC
TOR
  760                     LDA #ROUTI
NE1/256
  770                     STA HI.VEC
TOR
  780                     LDA #RASTE
R1
  790                     STA RASCOM
PARE
  800                     ;SET VIC I
RQ FLAG
  810                     LDA #$01
  820                     STA VICIRQ
  830                     JMP $EA31
```

PROGRAM: LISTING 2

```
  570                     ;
  580                     ;
  590                     ;REWORKED
ROUTINE
  600 ROUTINE2            LDA #ROUTI
NE1&255
  610                     STA LO.VEC
TOR
  620                     LDA #ROUTI
NE1/256
  630                     STA HI.VEC
TOR
  640                     LDA #RASTE
R1
  650                     STA RASCOM
PARE
  660                     ;CHANGE CO
LOUR TO BLACK
  670                     LDA #BLACK
  680                     STA BORDER
  690                     STA SCREEN
  700                     ;SET VIC I
RQ FLAG
  710                     LDA #$01
  720                     STA VICIRQ
  730                     JMP $EA31
  740                     ;DELETE OL
D LINES 750-830
```

PROGRAM: LISTING 3

```
  10                      .ORG    $C
000
  20 CIAIRQMASK           =$DC0D
  30 CIAIRQREG            =$DD0D
  40 VICCTRL              =$D011
  50 RASCOMPARE           =$D012
  60 RASTER1              =$0A
  70 RASTER2              =$9E
  80 YELLOW               =$07
  90 BLACK                =$00
 100 BORDER               =$D020
 110 SCREEN               =$D021
 120 LO.VECTOR            =$0314
 130 HI.VECTOR            =$0315
 140 VICIRQ               =$D019
 150 IRQMASK              =$D01A
 160 INITIALISE           SEI
 170                      JSR CHARMO
VE
 180                      ;DISABLE I
RQ
 190                      LDA #$1F
 200                      STA CIAIRQ
MASK
 210                      STA CIAIRQ
REG
 220                      ;ENABLE IR
Q
 230                      LDA CIAIRQ
MASK
 240                      LDA CIAIRQ
REG
 250                      LDA VICCTR
L
 260                      AND #$7F
 270                      STA VICCTR
L
 280                      ;CHANGE $0
314 VECTOR TO ROUTINE 1
 290 SETPOINT             LDA #ROUTI
NE1&255
 300                      STA LO.VEC
TOR
 310                      LDA #ROUTI
NE1/256
 320                      STA HI.VEC
TOR
 330                      ;ENABLE IR
Q
 340                      LDA #$01
 350                      STA IRQMAS
K
 360                      ;SET RASTE
R INTERRUPT CONTROL TO FIRST SPL
IT
 370 RASTERUPT            LDA #RASTE
R1
 380                      STA RASCOM
PARE
 390                      ;RETURN TO
 BASIC
 400                      CLI
 410                      RTS
 420                      ;
 430                      ;
 440                      ;SET COLOU
R TO YELLOW
 450 ROUTINE1             LDA #YELLO
W
 460                      STA BORDER
 470                      STA SCREEN
 480                      LDA $D018
 490                      AND #$F0
 500                      ORA #$04
 510                      STA $D018
 520                      ;SET INTER
RUPT VECTORS FOR SECOND SPLIT
 530                      LDA #ROUTI
NE2&255
 540                      STA LO.VEC
TOR
 550                      LDA #ROUTI
NE2/256
 560                      STA HI.VEC
TOR
 570                      LDA #RASTE
R2
 580                      STA RASCOM
PARE
 590                      LDA #$01
 600                      STA VICIRQ
 610                      JMP $EA31
 620                      ;
 630                      ;
 640                      ;REWORKED
ROUTINE
 650 ROUTINE2             LDA #ROUTI
NE1&255
 660                      STA LO.VEC
TOR
 670                      LDA #ROUTI
NE1/256
 680                      STA HI.VEC
TOR
 690                      LDA #RASTE
R1
 700                      STA RASCOM
PARE
 710                      ;CHANGE CO
LOUR TO BLACK
 720                      LDA #BLACK
 730                      STA BORDER
 740                      STA SCREEN
 750                      LDA $D018
 760                      AND #$F0
 770                      ORA #$06
 780                      STA $D018
 790                      ;SET VIC I
RQ FLAG
 800                      LDA #$01
 810                      STA VICIRQ
 820                      JMP $EA31
 830                      ;
 840                      ;
 850                      ;SWITCH IN
 CHARACTER ROM
 860 CHARMOVE             LDA $01
 870                      AND #$FB
 880                      STA $01
 890                      ;MOVE CHAR
ACTER DATA TO $1000
 900                      LDY #$00
 910 LOOP                 LDA $D000,
Y
 920                      STA $1000,
Y
 930                      LDA $D100,
Y
 940                      STA $1100,
Y
 950                      LDA $D200,
Y
 960                      STA $1200,
Y
 970                      LDA $D300,
Y
 980                      STA $1300,
Y
 990                      LDA $D800,
Y
1000                      STA $1800,
Y
1010                      LDA $D900,
Y
```

```
                STA $1900,Y
                LDA $DA00,Y
                STA $1A00,Y
                LDA $DB00,Y
                STA $1B00,Y
                INY
                BNE LOOP
                ;SWITCH OUT CHARACTER ROM
                LDA $01
                ORA #$04
                STA $01
                RTS
```

PROGRAM: LISTING 4

PROGRAM: BASIC LOADER

```
F5  0 DATA 120, 32, 130, 192, 169, 31, 141, 13
4D  1 DATA 220, 141, 13, 221, 173, 13, 220, 173
A0  2 DATA 13, 221, 173, 17, 208, 41, 127, 141
65  3 DATA 17, 208, 169, 48, 141, 20, 3, 169
52  4 DATA 192, 141, 21, 3, 169, 1, 141, 26
97  5 DATA 208, 169, 10, 141, 18, 208, 88, 96
D5  6 DATA 169, 7, 141, 32, 208, 141, 33, 208
C1  7 DATA 173, 24, 208, 41, 240, 9, 4, 141
2B  8 DATA 24, 208, 169, 89, 141, 20, 3, 169
A5  9 DATA 192, 141, 21, 3, 169, 158, 141, 18
0B  10 DATA 208, 169, 1, 141, 25, 208, 76, 49
3E  11 DATA 234, 169, 48, 141, 20, 3, 169, 192
43  12 DATA 141, 21, 3, 169, 10, 141, 18, 208
6F  13 DATA 169, 0, 141, 32, 208, 141, 33, 208
24  14 DATA 173, 24, 208, 41, 240, 9, 6, 141
45  15 DATA 24, 208, 169, 1, 141, 25, 208, 76
1B  16 DATA 49, 234, 165, 1, 41, 251, 133, 1
93  17 DATA 160, 0, 185, 0, 208, 153, 0, 16
BB  18 DATA 185, 0, 209, 153, 0, 17, 185, 0
D6  19 DATA 210, 153, 0, 18, 185, 0, 211, 153
3D  20 DATA 0, 19, 185, 0, 216, 153, 0, 24
B4  21 DATA 185, 0, 217, 153, 0, 25, 185, 0
1C  22 DATA 218, 153, 0, 26, 185, 0, 219, 153
0E  23 DATA 0, 27, 200, 208, 205, 165, 1, 9
D4  24 DATA 4, 133, 1, 96,-1
45  100 READA:IFA=-1THENEND
A7  110 POKE49152+B,A
69  120 B=B+1
3C  130 GOTO100
```

PRG-NAME: BYT'TYPEWRITER
FILENAME: CURSOR RT'S

```
                ORG 50000
;
IRQVECTOR  EQU $0314
NORMALIRQ  EQU $EA31
COUNT      EQU 170
CURSFLAG   EQU 171
;
;
                JMP CURSORON
                JMP CURSOROFF
;
;
;     ***  TURN CURSOR ON  ***
;
CURSORON   SEI
                LDA #<FLASHCURS
                STA <IRQVECTOR
                LDA #>FLASHCURS
                STA >IRQVECTOR
;
                LDA #0
                STA CURSFLAG
                STA COUNT
;
                CLI
                RTS
;
;
;
;
;     ***  TURN CURSOR OFF  ***
;
CURSOROFF  SEI
                LDA #<NORMALIRQ
                STA <IRQVECTOR
                LDA #>NORMALIRQ
                STA >IRQVECTOR
                CLI
                RTS
;
;
;
;******************************
;
; ***  FLASH CURSOR ROUTINE  **
;
; (THIS ROUTINE IS CALLED EVERY
;       60TH OF A SECOND.)
;
;BUMP REAL TIME CLOCK.
;
FLASHCURS JSR $FFEA
;
;UPDATE COUNTER. IF 20 HAS BEEN
;REACHED, CHANGE CURSOR. ELSE
;EXIT STRAIGHT AWAY.
;
                INC COUNT
                LDA COUNT
                CMP #20
                BNE EXIT
;
;RESET COUNTER AND TEST CURSFLAG
;
CHANGE     LDA #0
                STA COUNT
;
                LDA CURSFLAG
                BNE PRINTCHAR
;
;PRINT INVERTED CHARACTER...
;
                INC CURSFLAG
                LDY #0
                LDA (SCREENMEM),Y
                CLC
                ADC #128
                STA (SCREENMEM),Y
                LDA #6
                STA (SCREENCOL),Y
                BNE EXIT
;
;OR NORMAL CHARACTER.
;
PRINTCHAR DEC CURSFLAG
                LDY #0
                LDA (SCREENMEM),Y
                SEC
                SBC #128
                STA (SCREENMEM),Y
                LDA #6
                STA (SCREENCOL),Y
;
;
;
;DO REST OF NORMAL INTERUPT-RT.
;
EXIT       JMP $EA7B
```

PRG-NAME: BYT'TYPEWRITER
FILENAME: TYPEWRITER RT

```
                ORG 49152
;
SCREENMEM EQU 251
SCREENCOL EQU 253
TEXTFILE  EQU 168
;
GETIN     EQU $FFE4
CURSORON  EQU 50000
CURSOROFF EQU 50003
;
;
;INITIATE TEXTFILE.
;
                LDA #<10000
                STA <TEXTFILE
                LDA #>10000
                STA >TEXTFILE
;
;INITIATE SCREEN AND COLOUR VARS.
;
                LDA #<1024
                STA <SCREENMEM
                LDA #>1024
                STA >SCREENMEM
;
                LDA #<55296
                STA <SCREENCOL
                LDA #>55296
                STA >SCREENCOL
;
;CLEAR THE SCREEN.
;
                JSR $E544
;
;SWITCH COMPUTER INTO
;BUSINESS MODE.
;
                LDA #14
                JSR $E716
;
;TURN INTERRUPT-DRIVEN CURSOR ON.
;
                JSR CURSORON
;
;
;
;WAIT FOR KEYPRESS.
;
GETKEY     JSR GETIN
                BEQ GETKEY
;
;IF F1 PRESSED, EXIT.
;
                CMP #133
                BNE GETKEY1
                JMP EXIT
;
;IF DELETE KEY HAS BEEN PRESSED,
;JUMP TO DELETION & CRSR LEFT RT
;
GETKEY1    CMP #20
                BEQ DELE.CRSR
;
;IF CRSR LEFT, DITO.
;
                CMP #157
                BEQ DELE.CRSR
;
;IF CRSR RIGHT, JUMP FORWARD.
;
```

```
710           CMP #29
720           BEQ CURSRIGHT
730  ;
740  ;
750  ;
760  ;STORE CHARACTER IN TEXTFILE.
770  ;
780           LDY #0
790           STA (TEXTFILE),Y
800  ;
810  ;CONVERT ASCII INTO SCREEN CODE.
820  ;
830           CMP #128
840           BCC SKIP
850           SBC #64      ;UPPER CASE
860  SKIP     CMP #64      ;LOWER CASE
870           BCC PRINT
880           SBC #64
890  ;
900  ;PRINT CHARACTER ONTO SCREEN.
910  ;
920  PRINT    STA (SCREENMEM),Y
930           LDA #6
940           STA (SCREENCOL),Y
950  ;
960  ;ADVANCE TO NEXT PRINT POSITION.
970  ;
980  CURSRIGH1 INC <TEXTFILE
990           BNE NOHIGH
1000          INC >TEXTFILE
1010 ;
1020 NOHIGH   INC <SCREENMEM
1030          BNE NOHIGH1
1040          INC >SCREENMEM
1050 ;
1060 NOHIGH1  INC <SCREENCOL
1070          BNE GETKEY
1080          INC >SCREENCOL
1090          BNE GETKEY
1100 ;
1110 ;
1120 ;
1130 ;CRSR RIGHT ROUTINE:
1140 ;RECOVER CHARACTER TO THE LEFT
1150 ;AND JUMP BACK TO MAIN ROUTINE.
1160 ;
1170 CURSRIGHT LDY #0
1180          LDA (SCREENMEM),Y
1190          CMP #128
1200          BCC PRINT2
1210          SBC #128
1220 PRINT2   STA (SCREENMEM),Y
1230          LDA #6
1240          STA (SCREENCOL),Y
1250 ;
1260          BNE CURSRIGH1
1270 ;
1280 ;
1290 ;
1300 ;DELETION & CRSR LEFT ROUTINE:
1310 ;
1320 ;IF BEG. OF SCREEN, EXIT.
1330 ;
1340 DELE.CRSR LDX #<1024
1350          CPX <SCREENMEM
1360          BNE START
1370          LDX #>1024
1380          CPX >SCREENMEM
1390          BEQ GETKEY
1400 ;
1410 ;SAVE ACCUMULATOR.
1420 ;
1430 START    PHA
1440 ;
1450 ;RECOVER CHARACTER TO THE LEFT.
1460 ;
1470          LDY #0
1480          LDA (SCREENMEM),Y
1490          CMP #128
1500          BCC PRINT1
1510          SBC #128
1520 PRINT1   STA (SCREENMEM),Y
1530          LDA #6
1540          STA (SCREENCOL),Y
1550 ;
1560 ;GO ONE POSITION BACKWARDS.
1570 ;
1580          LDA <TEXTFILE
1590          BNE NOHIGH2
1600          DEC >TEXTFILE
1610 NOHIGH2  DEC <TEXTFILE
1620 ;
1630          LDA <SCREENMEM
1640          BNE NOHIGH3
1650          DEC >SCREENMEM
1660 NOHIGH3  DEC <SCREENMEM
1670 ;
1680          LDA <SCREENCOL
1690          BNE NOHIGH4
1700          DEC >SCREENCOL
1710 NOHIGH4  DEC <SCREENCOL
1720 ;
1730 ;RECOVER ACCUMULATOR AND TEST IT.
1740 ;IF CRSR LEFT, EXIT.
1750 ;
1760          PLA
1770          CMP #157
1780          BEQ CRSREXIT
1790 ;
1800 ;PRINT A SPACE OVER LETTER.
1810 ;
1820          LDY #0
1830          LDA #32            ;SPACE
1840          STA (TEXTFILE),Y
1850          STA (SCREENMEM),Y
1860          LDA #6             ;BLUE
1870          STA (SCREENCOL),Y
1880 ;
1890 CRSREXIT JMP GETKEY
1900 ;
1910 ;
1920 ;
1930 ;
1940 ;MAIN EXIT:
1950 ;TURN INTERRUPT DRIVEN CURSOR OFF
1960 ;AND RETURN TO BASIC.
1970 ;
1980 EXIT     JSR CURSOROFF
1990          RTS
```

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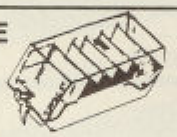
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Plus/4 Extended Basic

The author of the Plus/4 Extended Basic program that appeared in our *1987 Serious Users Guide* has provided us with a number of updates to the program. All of the alterations are made to Listing 1. The changes are as follows:

```
86 POKE DEC("13A9"),21
100 SYS 8020"EXTENDED BASIC",
1,4097,8605
```

A number of errors also appeared in the text for this program.

The line to be added should the fast loader be used is:

```
95 IFD$="T"THENSYSDEC
("3D00")
```

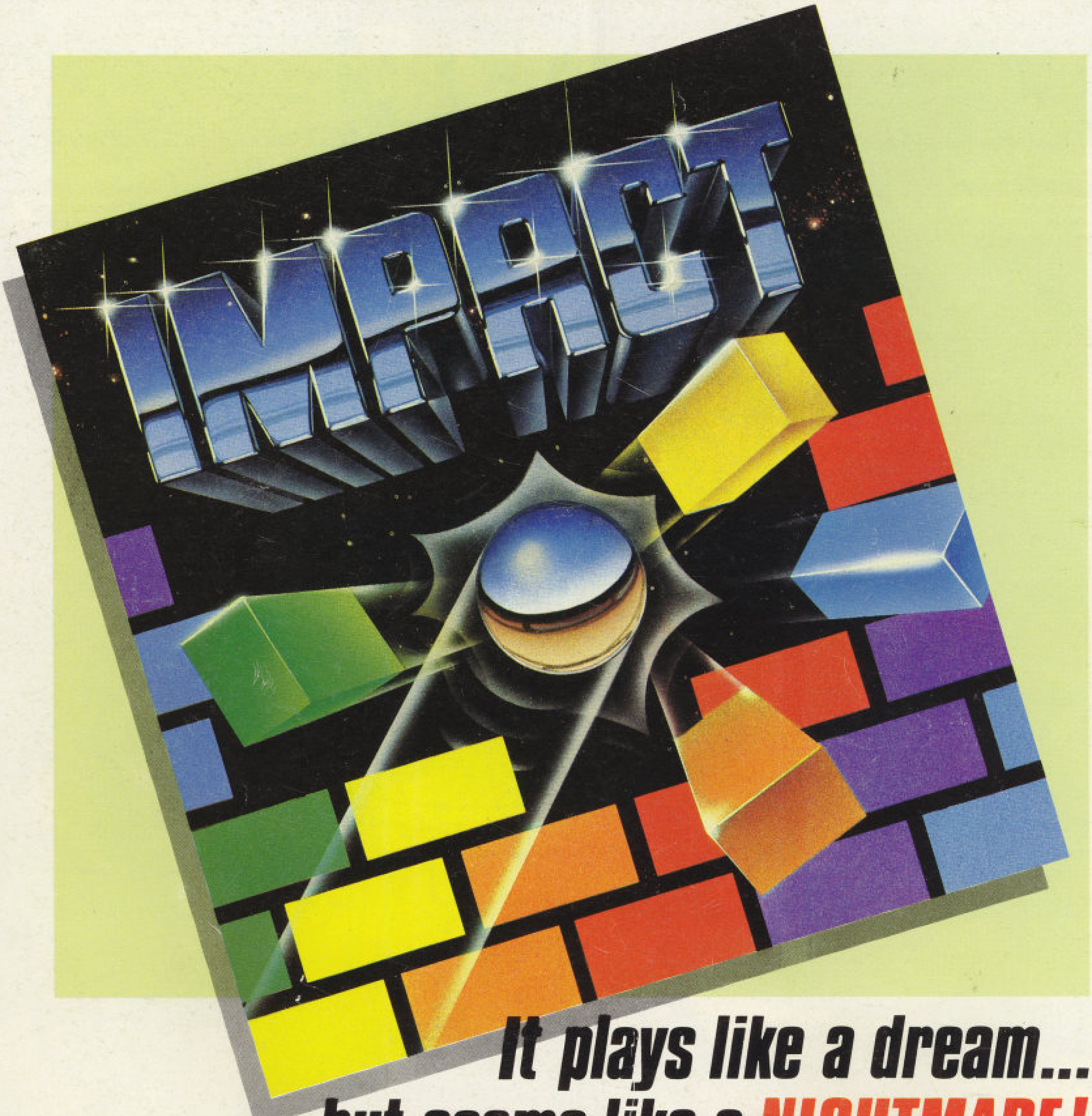
The RECORD format is incorrect. This should be:
RECORD CHANNEL,RECORD [OFFSET]

The RECORD command also assumes that file 15 has opened as the command channel.

The DMERGE format is the same as the normal DLOAD command.

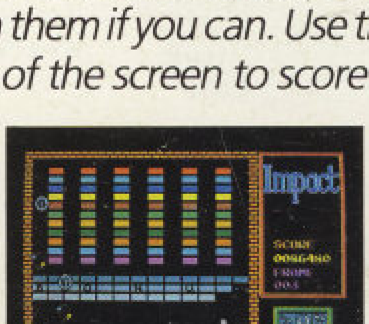


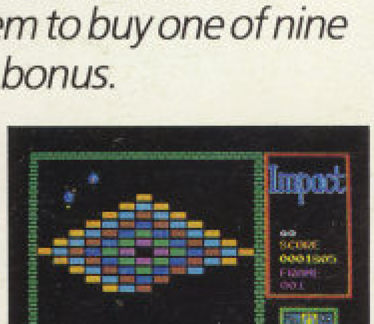
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